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RETRACTABLE DEBT INSTRUMENTS AND THE PROVISION OF MORTGAGE RATE INSURANCE AND/OR THE INTRODUCTION OF 10-YEAR MORTGAGES CALLABLE AFTER 5 YEARS

A Report Prepared for Canada Mortgage and Housing Corporation

by

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(i) Executive Summary

I. CONTENT AND CONCEPTS

Chapter 1: OVERVIEW OF THE ALTERNATIVE INITIATIVES

1. Mortgage payment insurance is functionally equivalent to providing the borrower with a 10-year, callable mortgage.

2. The demand and supply of the relevant call option will determine both its price and the quantity bought and sold. There can be no presumption that the callable mortgage (or its equivalent) will dominate the market, nor even exceed some target fraction of new mortgages and renewals.

3. There exists considerable uncertainty regarding the location and elasticities of the relevant demand and supply schedules.

4. The advantages and disadvantages of the following policy initiatives are briefly previewed in this chapter:

   (1) mortgage rate/payment insurance, involving the sale of callable bonds;

   (2) 10-year, callable mortgages from CMHC, financed by callable bonds;

   (3) 10-year, callable mortgages from private lending institutions, financed by callable deposits;

   (4) the introduction of mortgage-backed, pass-through securities by the CMHC, tied to pools of 10-year, callable mortgages.

5. Criteria to evaluate the initiatives include the importance of the call option bearing a market-determined price and the minimization of underwriting risk to the CMHC.

6. Two broad conclusions emerge from this preview:

   (1) Instrument risk, emanating from the fact that the CMHC would be insuring mortgages but issuing callable bonds, is important and represents a major limitation of mortgage rate insurance proposal.

   (2) Mortgage-backed, pass-through securities appear to be the most attractive of the alternative initiatives. Their success in the United States provides an important market signal as well as a forum for efficient learning.

Chapter 2: EXPERIENCE IN OTHER COUNTRIES

1. In the United States, mortgage rate insurance has been discussed - but not implemented - in the context of easing the problems of thrift institutions which borrow short and lend long. It is not directly analogous to the mortgage rate insurance being discussed in Canada.

2. GNMA mortgage-backed, pass-through securities have improved the liquidity of the secondary mortgage market by introducing a standardized instrument with a guarantee of timely payment of interest and principal.

   (1) In part, the introduction of these securities was deemed necessary to reduce start-up costs and to familiarize the market with the instrument.

   (2) In the main, the emphasis when introduced was on increasing the effective supply of mortgage credit. (In Canada, by contrast, the emphasis is on making effective the potential demand for longer-term mortgage loans.)

   (3) The success of these and other mortgage-backed, pass-through securities in the United States is reviewed, and the innovation and growth in this market are noted.

3. Because FHA and VA mortgage loans in the United States can be prepaid at any time without penalty, long-term callable mortgages effectively exist. There appears to be no evidence that institutions have sought to lay off this risk by issuing the equivalent of callable bonds or deposits.

Chapter 3: THE IMPACT OF THE ALTERNATIVE INITIATIVES ON THE CAPITAL MARKET

1. Only mortgage-backed securities are likely to produce a rightward shift in the supply as well as in the demand schedule for mortgage credit.

2. Domestic saving is likely to be largely unaffected by all of the initiatives, and any net increase in the flow of mortgage credit is likely to be accompanied by reduced access of other sectors to domestic saving and an increase in their reliance on foreign saving. The magnitude of these effects is uncertain, reflecting the uncertainty regarding the demand for the proposed mortgage instrument, but is not likely to be large.

3. International capital flows will limit any increase in the overall level of domestic interest rates, although the relative cost of mortgage credit (abstracting from the call option) will unambiguously rise in all cases except for mortgage-backed securities.

4. The potential impact of certain of the initiatives (mortgage-backed securities, callable mortgage loans issued by the CMHC) is likely to be greatest on the flow of funds through traditional mortgage-lending institutions. These institutions will feel pressure either to participate in a new initiative (for example, as buyers of mortgage-backed securities) or to implement parallel initiatives (for example, by issuing callable deposits).

Chapter 4: MORTGAGE-BACKED SECURITIES: THE PERSPECTIVE FROM MODERN FINANCE THEORY

1. Although the coupon on a callable mortgage will exceed that on a non-callable mortgage (if both are issued at par) in order to compensate the holder for the option, the expected return on the callable mortgage may well be less. The expected return is, of course, the "correct" measure of the anticipated cost to the borrower of taking out the mortgage loan.

2. A brief review of U.S. experience identifies reasons why realized returns on GNMA securities, over the period 1971-1978, actually exceeded those on long-term U.S. Government bonds.

3. The chapter discusses in detail a theoretical example of the pricing of GNMA and like securities, drawn from the finance literature.

   (1) Prepayments not related to a decline in interest rates, which are likely in Canada because of tax incentives, lower the expected return on GNMA or like securities.

   (2) The call option has a greater value, the longer is the term to maturity of the mortgage in which it is embedded.

   (3) The coupon rate (and the expected return) on an amortized mortgage will be less than that on a non-amortized mortgage when both are issued at par.

Chapter 5: THE GENERAL PROBLEM OF RISK BEARING (OR "WHO WILL HOLD THE CALLABLE DEBT INSTRUMENTS?")

1. If mortgage borrowers are to have - either directly or through the vehicle of mortgage payment insurance - 10-year callable mortgages, then some other individuals or institutions must be persuaded to sell the call options.

2. The holder of a 10-year callable mortgage has the equivalent of a straight 5-year mortgage less a put option. (The holder also has the equivalent of a straight 10-year mortgage less a call option, although this fact is less useful since straight 10-year mortgages do not exist.)

    (1) The value of this put option will rise if either the slope of the yield curve increases or the degree of uncertainty regarding future interest rates increases.

    (2) Since the value of this put option will vary over time, so will the spread between the 10-year callable mortgage and the straight 5-year mortgage rate.

    (3) At present, this spread is likely to be in the vicinity of 100 basis points.

3. Since the holder of GNMA mortgage-backed securities has sold a call option (since the borrower can prepay the 30-year mortgage at any time without penalty), the comparison of the yield on these securities relative to 30-year Treasury bonds is instructive.

    (1) The maximum historical spread between the rates on these two types of securities was 250 basis points (August 1981).

    (2) The option to call a 10-year mortgage after 5 years is far less valuable than the option to call a 30-year mortgage at any time. This fact is illustrated in the text.

    (3) Although prepayments unrelated to mortgage rate declines make the reported yield spread in the United States a downwardly biased estimate of the amortized value of the call option, we are willing to conjecture that the yield premium in Canada on 10-year callable relative to straight 5-year mortgages is not likely to exceed 125 to 150 basis points even under the most adverse circumstances.

4. The yield premium on callable mortgages (or pass-through, mortgage-backed securities) suggests they may be attractive to tax-exempt investors such as pension funds, whose longer-term investment horizons and need to make annuity payments are also well matched to the proposed instrument.

5. The use of call premiums and/or sinking funds would reduce (but not eliminate) the risk borne by the sellers of the call option, and thus its price. Monitoring current developments in the United States to see how mortgage-backed securities are being tailored to the needs of different types of investors should be instructive on this account.

Chapter 6: ISSUES IN THE IMPLEMENTATION OF THE ALTERNATIVE INITIATIVES

1. Before implementing any proposed, its exact features must be fully specified.

2. Because of the uncertainty regarding the potential demand for 10-year callable mortgages by prospective borrowers, it is reasonable for the CMHC to initiate a trial program. The CMHC could:

   (1) issue (say) $25 million in callable bonds, and then offer to make 10-year callable mortgages at the 5-year mortgage rate plus the amortized cost of the relevant option;

   (2) offer to make 10-year callable mortgages to a limit of $25 million, using the 5-year rate plus 100 basis points as the mortgage rate, and then sell $25 million of callable bonds;

   (3) offer to make 10-year callable mortgages to a limit of $25 million, as above, and then selling $25 million of mortgage-backed securities.

3. The risks to which the CMHC would be exposed, and related start-up issues, are analyzed for each of these alternatives.

Appendix A: THE MECHANICS OF THE PESANDO-TURNBULL PROPOSAL FOR MORTGAGE RATE INSURANCE

1. The mechanics of a mortgage rate insurance program which keys on the issuance of callable bonds by the CMHC are illustrated and various subtleties noted.

2. The underwriting risks to which the CMHC is exposed are illustrated by examples which involve an increase, a decrease and no change in the spread between mortgage and bond rates. The CMHC will in general experience an underwriting loss (gain) if this spread increases (decreases).

3. The amortization risk associated with mortgage payment insurance is also illustrated.

4. To eliminate instrument and amortization risk, the CMHC would have to issue a callable debt instrument with the exact characteristics of a mortgage (including amortization of principal) and that instrument would have to be priced by the market as if it were a mortgage.

Appendix B: INSTRUMENT RISK IN THE MORTGAGE RATE INSURANCE PROPOSAL

1. Data on the spread between the 5-year conventional mortgage rate and the rate on 3-5 year Government of Canada bonds are anlayzed. The substantial variation in this spread, and its serial correlation, are noted.

2. The analysis suggests that (1) CMHC would be exposed to substantial underwriting risk, (2) the "catastrophic" scenario of a secular rise in the mortgage-bond spread is remote, and (3) although underwriting gains and losses are likely to net out in the long run, there can be no presumption that they will "wash" quickly.

Appendix C: ALTERNATIVES TO MORTGAGE RATE (OR PAYMENT) INSURANCE: CALLABLE MORTGAGE LOANS FINANCED BY CALLABLE DEBT INSTRUMENTS

1. The analysis indicates that if the CMHC (or a private lending institution) issues callable bonds to finance callable mortgage loans, the CMHC will bear amortization or reinvestment risk, but not instrument risk.

2. Amortization or reinvestment risk could also be eliminated if the CMHC (or private lending institution) issued callable, amortized debt instruments to finance its callable mortgages.

II. POLICY RECOMMENDATIONS

1. Because mortgage rate/payment insurance is redundant if 10-year, callable mortgages are introduced, and since mortgage rate/payment insurance which keys on the issuance of callable bonds by the CMHC exposes the CMHC to instrument and amortization risk, it is recommended that mortgage rate/payment insurance be dropped from the list of contemplated policy initiatives.

   (1) In announcing this decision, the CMHC should emphasize this redundance, in the context of an initiative designed to introduce 10-year, callable mortgages. (See below.)

   (2) The full market price of the call option would, through competitive market forces, be embodied in the interest rate on 10-year, callable mortgages. No such result holds for any of the mortgage rate/payment insurance proposals previously under consideration.

2. Absent the consideration of start-up costs, the most attractive way of introducing 10-year, callable mortgages is in the form of mortgage-backed, pass-through securities with a guarantee of timely payment by the CMHC. This should be the long-run objective towards which preliminary initiatives are directed.

   (1) This is the only initiative which may increase the supply (as well as the demand) for mortgage credit.

   (2) Because of the pass-through feature, the mortgages rates on these securities will be market-determined, with the holders of the securities being compensated for their sale of the call option.

   (3) CMHC's sole risk exposure (assuming mortgages are insured against default) is in its guarantee of timely payment, and the experience with GNMA mortgage-backed securities in the U.S. should provide evidence regarding the market price of this guarantee.

   (4) The success of mortgage-backed securities in the United States, together with their continuing evolution, provides an important market signal regarding their acceptability to ultimate lenders.

   (5) Mortgage-backed securities in the United States were pioneered by the GNMA, which bore the start-up costs and familiarized the market with the instrument. A similar role is suggested for the CMHC in Canada.

3. In order to establish the (unknown) demand for 10-year, callable mortgages, it is recommended that the CMHC initiate a trial issue. The CMHC could announce its intention to provide (say) $25 million of 10-year, callable mortgages. The rate would be the current 5-year rate plus 100 basis points, which represents a "guesstimate" of the market value of the relevant option.

   (1) The trial issue would be financed either by (1) the CMHC's issuing callable bonds or (2) by the CMHC's packaging the mortgages in pools and selling mortgage-backed securities.

   (2) Depending upon whether or not the mortgages were scheduled for forward delivery, the CMHC might need to establish an interim line of credit in order to provide the mortgage funds.

   (3) If the initial reception is lukewarm, the CMHC might initially opt to finance the mortgages by issuing callable bonds. If the reception is very positive, the CMHC might feel that it can justify incurring the larger start-up costs associated with the introduction of mortgage-backed securities.

   (4) As discussed in the text of the report, the risks to which the CMHC would be exposed are readily identified and do not appear to be large, so long as the size of the trial issue is limited.

   (5) For this initiative to go forward, it will be necessary to interface with practitioners in order to "flesh out" the details.

4. The making of direct 10-year, callable mortgage loans by the CMHC, financed by the sale of callable bonds is a less attractive, long-run initiative then the CMHC financing such loans with mortgage-backed securities.

   (1) Because the CMHC would bear both instrument risk and amortization risk, it would not be possible to use the spread between straight 5-year bonds and the 5-year extendible (i.e. the 10-year callable) bonds as the market-determined yield premium to be added to the straight 5-year mortgage rate to price the 10-year, callable mortgages. This spread would <u>understate</u> the appropriate yield premium.

   (2) The initiative would (largely) displace mortgage lending by financial institutions, at least until private financial institutions sought to emulate the initiative. In turn, this would be hampered if the CMHC were implicitly or explicitly subsidizing its 10-year, callable mortgages.

5. It is recommended that the CMHC encourage the development of an active and liquid secondary market in mortgage-backed securities. To facilitate such a development, it is recommended that, at least initially, the mortgage-backed securities be tied to pools of mortgages which have a common format. Since tax exempt pension funds are a potential buyer of these or similar securities, they should be involved in preliminary discussions on this issue, as should financial institutions which have experience with these types of securities.

   (1) The development of a liquid secondary market in mortgage-backed securities will be a potential benefit to all financial institutions, as it introduces a new form of financial instrument, as well as providing mortgage lenders with a ready means to adjust their mortgage portfolios.

   (2) The development of mortgage-backed securities will provide a positive incentive for private lending institutions to sell 10-year, callable mortgages, as such institutions will have a ready means, if desired, to offset the risk.

   (3) The development of a liquid secondary market in mortgage-backed securities will facilitate the introduction of futures and/or options markets. The introduction of these derivative capital markets will attract a broader class of participants and will provide additional means for mortgage lending institutions to adjust the risk exposure of their portfolios.

6. The proposed introduction of 10-year, callable mortgages is an initiative which may serve the needs of a subset of mortgage borrowers and lenders. At the same time, it must be recognized that other initiatives (such as indexed mortgages) may also serve the needs of some borrowers and lenders.

I. OVERVIEW OF THE ALTERNATIVE INITIATIVES

1. The Problem

The recent volatility of mortgage rates has drawn attention to the possibility that mortgage borrowers may wish to fix the level of current and future nominal mortgage payments for more than 5 years. There are two initiatives which might allow borrowers to reduce the risk associated with the level of future mortgage payments:

(1) mortgage rate insurance (MRI) or, preferably, mortgage payment insurance (MPI)*; and

(2) 10-year (or longer) mortgage loans, which would be callable at the borrower's option after 5 years.

If a borrower wished to fix his nominal mortgage payments for a period in excess of 5 years, he could (1) take out MPI or (2) take out a 10 year (or longer) mortgage which, under Section 10 of the Interest Act, must be repayable with a 3-month interest penalty at any time 5 years after the date that the mortgage is taken out. MPI, which would allow the borrower to extend the term of a 5-year mortgage for an additional 5 years at (say) the initial mortgage rate, is functionally equivalent to the borrower's having a 10-year mortgage which is callable without penalty after 5 years.**

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* Mortgage rate insurance (MRI) insures against changes in the level of interest payments. Mortgage payment insurance (MPI) insures against changes in the level of both interest payments and principal payments. See Appendix A for details.

** It is important to note that prepayment options in general may serve a different purpose from MRI. In Canada, there are tax incentives to effectively encourage prepayment privileges. (Borrowing for investment purposes is tax deductible, while mortgage payments are non-deductible.) We return to this point in our assessment of the attractiveness of callable debt instruments to investors.

If, in effect, the mortgage borrower is to be provided with the option of calling a 10-year mortgage after 5 years, then some lender must be compensated for bearing the interest rate risk associated with this call option. The demand by the mortgage borrower to shed this risk will depend upon the price of the call option. This price, in turn, will depend upon the willingness of lenders to supply the option. The question of who will bear this risk and at what cost is central to the analysis of both initiatives.

2. Overview: the Role of Demand and Supply Forces

The demand by mortgage borrowers to shed interest rate risk by (in effect) purchasing call options will presumably decline as the price of this option increases. The supply (in effect) of call options by ultimate lenders will be an increasing function of the price of this option. In equilibrium, the demand and supply for this call option will determine both its price and the quantity that is bought and sold. The risk preferences of mortgage borrowers and lenders will thus determine the extent to which MRI, MPI or the introduction of 10-year callable mortgages will be used by mortgage borrowers to reduce uncertainty regarding the future level of nominal mortgage payments. It is not possible to ascertain in advance the fraction of mortgage borrowers who would be attracted to one of these initiatives.

The call option could, in principle, be bought or sold directly. In practice, the MRI or MPI issuer or the issuer of 10-year callable mortgages will probably embed the option in a callable debt instrument and thus pass the risk on to a third party. If we assume that this is

initially the case, we can depict market equilibrium using a simple demand and supply diagram (Figure 1). On the vertical axis is the price of the call option, while on the horizontal axis are the quantity demanded and supplied of the callable debt instrument. Equilibrium when the demand schedule is DD and the supply schedule is SS occurs at price P_E, with quantity demanded and quantity supplied both equal to Q_E.

In fact, there exists uncertainty about both the location and the elasticities of the demand and supply schedules. At any point in time, only borrowers who are presently electing the maximum mortgage term of 5 years are likely to have non-zero demand at a positive price. The fact that the fraction of mortgage borrowers who opt for the maximum 5-year term changes over time suggests that the location of the demand schedule may shift over time. At present, the fraction of borrowers who are opting for the maximum 5-year term has increased, thus suggesting that the demand curve has shifted rightward in recent months. (In Figure 1, DD may have shifted to DD', corresponding to the increase in quantity demanded at a zero price from D_0 to D_0'.) We know very little about the elasticity of the demand schedule. Merrill Lynch, Royal Securities reports, based on discussions with builders, that buyers are interested in a 10-year mortgage instrument*. JDS Investments Ltd. has recently announced** that it will offer, on a trial basis, 10-year mortgages at its Westney Heights new home project in Ajax. Although both observations suggest that the quantity demanded of this call option at a positive price is likely to be non-zero, neither

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*Merrill Lynch, Royal Securities, Presentation to Canada Mortgage and Housing Corporation, March 1983, page 13.

**"Builder brings back 10-year mortgages". Toronto Star, March 26, 1983, page C1. These mortgages are, of course, open for renegotiation during their last 5 years.

conveys information regarding either the location or the elasticity of the demand schedule.

There also exists uncertainty regarding both the location and the elasticity of the supply schedule. In discussing either of the two initiatives, one continually hears the question: "who will buy" the callable bonds/debt instruments that are required if the issuer of MRI, MPI or callable mortgages is to pass the interest rate risk on to a third party? Indeed, there is likely to be some price (P_s in Figure 1) beneath which the quantity supplied is zero. Further, as interest rate uncertainty increases and/or the term structure becomes less steep, this price is likely to rise*. (This is shown as a shift of SS to SS", and thus of P_s to P_s'', in Figure 1.) Experience in the United States with "Ginnie Maes", whose underlying 30-year mortgages can be prepaid without penalty at any time, may be insightful in any attempt to assess the location and elasticity of the supply schedule depicted in Figure 1.

There are two other insights that economic analysis has to offer regarding the development of this market. First, the introduction of MRI, MPI or callable mortgages is likely to be accompanied by start-up costs which will disappear when market equilibrium is established. In addition, the initial price of the call option may be higher than its equilibrium price (for a given quantity), as ultimate lenders require time to familiarize themselves with the callable debt instrument.

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*See the analysis in J. Pesando and S. Turnbull, The Pricing and Reception of Bonds Extendible at the Option of the Government of Canada, study prepared for the Canada Mortgage and Housing Corporation, 13 May, 1983. In this paper, the authors show how a rise in the slope of the term structure raises the value of the put option considered in their analysis. A parallel argument would show how a decline in this slope will raise the value of the call option which is the focus of the present discussion.

Secondly, if there were no impediments or start-up costs associated with MRI, MPI or 10-year callable mortgage loans, then their absence would have to be viewed as a market signal that unsubsidized insurance/callable mortgage loans are not viable products*. From this perspective, the rationale for a CMHC initiative would appear to require the identification of start-up costs which prevent private markets from innovating without government help. It is worthwhile to note that the reduction in start-up costs and the desire to familiarize the market with a new product were major objectives in the U.S. Government's decision to introduce GNMA mortgage-backed securities.**

Finally, the inclusion of a "deductible", which is clearest in the context of MRI or MPI, may provide a means of keeping the price of the call option beneath some target level. The "deductible", if large, could mirror the desire by individuals to insure themselves against only particularly adverse outcomes. In addition, the use of sinking fund provisions may provide a means of reducing the uncertainty regarding prepayments, and thus the price of the call option.

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*This, of course, assumes that private agents have been aware of how these products could be introduced and have consciously decided against their introduction. This assumption may not be valid.

**R. Van Order and K. Villani, "A Study of GNMA Conventional Mortgage Pass-Through Security Program" in Occasional Papers in Housing and Community Affairs (U.S. Department of Housing and Urban Development, March 1981).

3. The Alternative Initiatives

1. The CMHC sells mortgage rate insurance, and uses callable bonds both to price the insurance and to shed the underwriting risk.

2. The CMHC issues 10-year callable bonds and uses the proceeds to make 10-year callable mortgage loans.

3. The CMHC persuades deposit-taking institutions to introduce callable deposits or GIC's, which are then used by these institutions to make 10-year callable mortgage loans.

4. The CMHC guarantees the timely payment of interest and amortized principle on mortgage-backed securities, in which the underlying mortgages are callable after 5 years and have an initial maturity of (at least) 10 years.

All of these initiatives invite, either directly or indirectly, the further development of futures and/or options markets. In turn, these should facilitate the shedding of interest rate risk by private lending institutions if they so desire. Of particular note in this regard is the importance of standardizing the terms (say) of the 10-year callable mortgages, as is the case with "Ginnie Mae" securities in the United States.

4. Criteria to Evaluate the Initiatives

1. The call option should bear a market-determined price.

2. The CMHC should bear no underwriting risk, either in its role as a seller of mortgage rate insurance or in its role as a financial intermediary which both borrows and makes direct mortgage loans.

3. The CMHC should ensure that its insurance and/or direct mortgage loans bear a competitive market price, so that the initiative could be emulated - at least in principle - by the private sector.

4. Other things equal, an initiative which has the minimal impact on other participants in the Canadian capital market is to be preferred.

5. Mortgage Rate Insurance

1. Operation

CMHC issues 10-year bonds callable after 5 years at its option, reinvests the proceeds in straight 5-year bonds, and uses the yield premium on the callable relative to the straight bonds as the annual cost of the insurance premium. (See Appendix A for details.)

2. Advantages

2.1 Absent instrument risk (emanating from the fact that the CMHC is issuing callable bonds but providing mortgage rate insurance), the CMHC (i) charges a market price for the insurance and (ii) sheds (or has the capacity to shed) all underwriting risk.

2.2 There is no subsidy to the insurance, although an explicit and known subsidy can be provided if desired.

2.3 The call option is priced in the market for primary securities, which have a well-developed secondary market.

2.4 The fact that the market price of the mortgage rate insurance will vary over time will be immediately apparent.

2.5 If the option is stripped from the callable bonds and begins to trade separately, then the need for the dual set of transactions might eventually disappear.

3. Disadvantages

3.1 Instrument risk is a major problem, and the claims that the insurance bears a market price and that the CMHC sheds all underwriting risk must be qualified accordingly.

3.2 Gross, but not net, borrowing by the Federal Government increases.

3.3 If the CMHC feels constrained to set insurance premiums at a fixed and unchanging level, the fact that these premiums are not market rates will be immediately apparent.

3.4 The pricing of the insurance requires two sets of transactions in the bond market, which raises transactions costs and poses possible co-ordination problems. These transactions costs should, of course, be reflected in the insurance premiums.

6. CMHC Issues Callable Bonds, Makes Callable Mortgage Loans

1. Operation

CMHC issues 10-year bonds callable after 5 years at its option. The CMHC extends 10-year mortgage loans, callable after 5 years at the borrower's option. The CMHC prices its mortgages by either (i) adding a mark-up to the rate on callable bonds to reflect administrative costs or (ii) adding the excess yield on the callable bonds relative to straight 5-year bonds to the 5-year mortgage rate to obtain the "market price" of the callable mortgages. (See Appendix C.)

2. Advantages

2.1 Absent amortization risk (emanating from the fact that mortgage principle is amortized while bond principle is not), the CMHC need bear no underwriting risk.

2.2 There is only one set of transactions in the bond market (unlike mortgage rate insurance).

3. Disadvantages

3.1 Gross and net borrowing by the Federal Government both increase.

3.2 Unless the CMHC sets the mortgage rate at the "market price", it will not be possible for private lenders to provide a competitive product.

3.3 Assuming (as a first pass) that the total amount of mortgage lending is unaffected by this initiative, private mortgage lending must fall by an amount equal to direct mortgage lending by the CMHC.

3.4 The CMHC is exposed to amortization risk.

7. The CMHC Persuades Private Lenders to Issue Callable Deposits, Make Callable Mortgage Loans

1. Operation

CMHC persuades (HOW?) deposit-taking institutions to issue 10-year deposits callable after 5 years at the issuer's option, and to make 10-year mortgage loans callable after 5 years at the borrower's option. (See Appendix C.)

2. Advantages

1. There is no direct CMHC involvement in either making mortgage loans or in selling mortgage rate insurance.

2. There is no change in either gross or net borrowing by the Federal Government.

3. Because there is no (continuing) CMHC involvement, there can be no hidden subsidies to mortgage borrowers.

3. Disadvantages

1. How is the CMHC to persuade deposit-taking institutions to act in this manner?

2. In effect, the call option will be priced by the holders of the deposits, which may not represent efficient risk bearing as these depositors may be relatively risk averse. These depositors have (i) chosen to acquire the claims of a financial intermediary rather than to acquire primary securities and (ii) there is no secondary market for these deposits, which may make their 10-year term unattractive on this account.

   (1) In its Green Paper, Better Pensions for Canadians, the Federal Government proposes the introduction of Registered Pension Accounts (RPA's), which would function like "locked-in" RRSP's.

   (2) RPA's would (i) lengthen the time horizon of investors and (ii) provide a tax shelter to the higher yield required on the callable deposits. As such, RPA's may reduce the importance of this disadvantage and/or facilitate a move in this direction by trust companies at some later date.

   (3) Deposit-taking institutions, as at present, bear amortization risk.

8. The CMHC Introduces and Guarantees Mortgage-Backed Securities

1. Operation

CMHC guarantees timely payment of interest and amortized principle on mortgage-backed securities, on which the underlying mortgages have terms of (at least) 10 years and are callable after 5 years. The call feature and other provisions of the mortgages are "passed through" to the holders of the mortgage-backed securities. A secondary market for the mortgage-backed securities is actively encouraged. Either CMHC extends directly the mortgage loans that comprise the pool, or designates qualified lenders as issuers of CMHC guaranteed mortgage-backed securities.

2. Advantages

2.1 Other than its guarantee of the timely payment of interest and amortized principle, there is no underwriting risk to the CMHC.

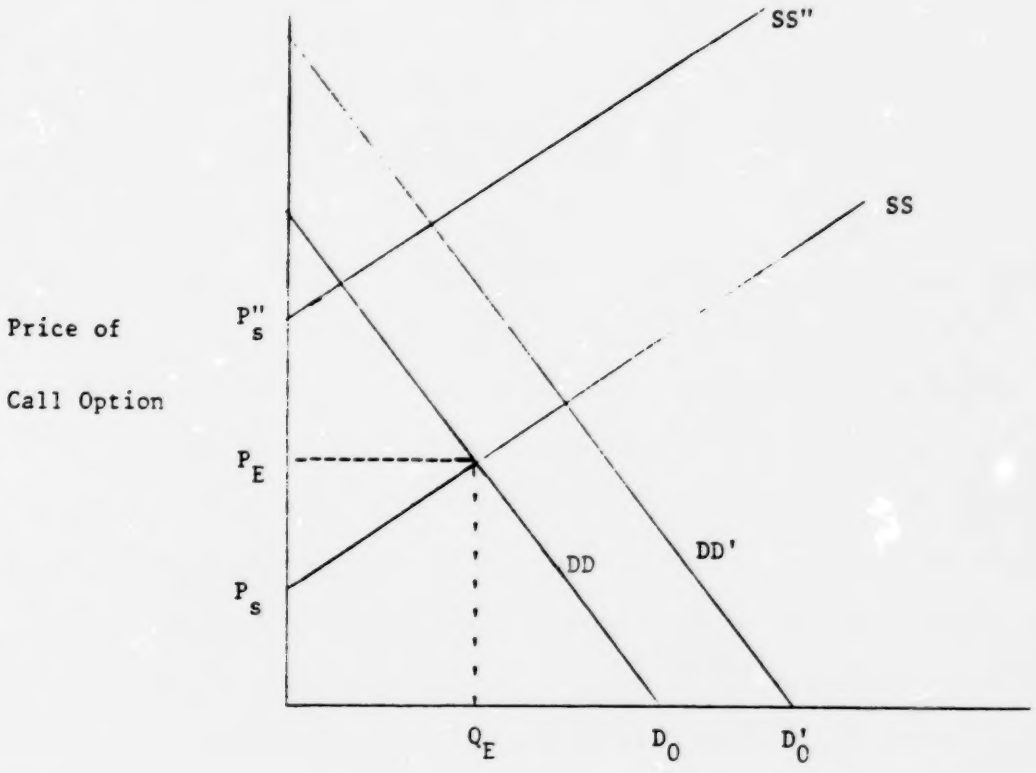
2.2 The price of the call option is market-determined, and risk bearing is likely to be efficient in that the mortgage-backed securities are held by (i) primary investors and (ii) have - or will have - a secondary market.

2.3 There is no gross or net increase in borrowing by the Federal Government.

2.4 The experience in the United States with mortgage-backed securities should provide an efficient "learning curve".

Figure 1-1

The Demand and Supply Schedules for the Call Option



Notes: 1. The shift from DD to DD' illustrates the rightward shift in the demand schedule that can be inferred from a decision by more households to take out mortgages with the present maximum term of 5 years.

2. The shift from SS to SS" depicts the leftward shift in the supply schedule which is likely to accompany an increase in interest rate uncertainty and/or a decline in the slope of the term structure.

2.5 As trust companies and other mortgage lenders gain experience, either by originating the callable mortgages which underlie the mortgage-backed securities or purchasing these securities as investments, the likelihood of further innovation by them increases.

2.6 The initial role and visibility of the CMHC are unambiguously necessary, while this is not necessarily the case for the other initiatives under consideration.

2.7 Holding constant the price of the call option, the improved liquidity of mortgage loans that would occur as a secondary market develops for the mortgage-backed securities should place downward pressure on mortgage rates. (It is unlikely, however, that the net result would be to reduce the yield on 10-year callable mortgages beneath the rate on straight 5-year mortgages.) The liquidity of the mortgage-backed securities will be improved if the underying mortgages have a standardized format, as do "Ginnie Maes" in the United States.

3. Disadvantages

3.1 At least initially, there will be a reduction in mortgage loans made by (and perhaps originated by) private lending institutions. (These institutions may, however, be purchasers of the mortgage-backed securities.)

II. EXPERIENCE IN OTHER COUNTRIES

Because the capital market in the United States is similar in many ways to the capital market in Canada, and since information regarding the mortgage market in the United States is readily available, we will focus our attention on experience in the United States.

1. Mortgage Rate Insurance

The concept of mortgage rate insurance has been raised - but (to our knowledge) not implemented - in the United States. An unanticipated increase in nominal interest rates can have serious financial implications for financial institutions that borrow short and lend long. For mortgage lenders this can be a serious problem and it can adversely effect the supply of mortgage funds. Edelstein and Guttentag* explore the idea of the U.S. Government providing mortgage rate insurance to financial institutions. The government would write an insurance policy with a thrift institution, such that the government would make (receive) payments of interest rates subsequently rise (fall). The thrift institution could thus shed the interest rate risk associated with borrowing short and lending long. Perhaps because of severe implementation problems and the uncertainty surrounding the possible magnitude of the liability, such an idea seems never to have implemented.

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*R. Edelstein and J. Guttentag, "Interest Rate Change Insurance and Related Prosposals to Meet the Needs of Home Buyers and Home Mortgage Lenders in an Inflationary Environment", Capital Markets and the Housing Sector: Perspectives on Financial Reform, edited by R.M. Buckley, J.A. Tuccillo, and K.E. Villani (Cambridge: Ballinger Publishing Co., 1977).

A suggestion more relevant to the Canadian discussion is made by Kaufman*, who calls for the creation of a Federal Mortgage Rate Insurance Corporation which could sell insurance directly to mortgage borrowers, should thrift institutions choose to shed interest rate risk by extending only variable rate mortgages. Mortgage borrowers would receive insurance payments if the variable rate charged over the life of the mortgage averaged more than the rate on a comparable fixed rate mortgage that could have been taken out at the same time. The key issue of determining a fair market price for the insurance and the implications if a subsidized price is used are given scant attention.

Mortgage rate insurance in the United States has been discussed as a possible means of ensuring that mortgage borrowers could continue to lock in a fixed nominal mortgage rate for the full amortization term of the mortgage, while reducing the interest rate risk borne by thrift institutions. The major reason the discussion is so different in the United States to that in Canada, presumably reflects the fact that the long-term, fixed interest mortgage has traditionally been the dominant mortgage instrument. In Canada, by contrast, the Interest Act effectively precludes a lender from locking in a fixed interest rate for a term in excess of 5 years, and the 5-year rollover mortgage has thus emerged as the dominant mortgage instrument.

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* G.G. Kaufman, "The Case for Mortgage Rate Insurance", Journal of Money, Credit and Banking, November 1975.

2. Mortgage-Backed Securities

The existing GNMA FHA/VA mortgage-backed securities program was authorized in the 1968 Housing Act under Title VIII, Section 804, which authorizes GNMA to guarantee pools of mortgages put together by FNMA and other qualified originators. The initial offering of pass-through GNMA securities was sold in 1970, and they have now gained wide acceptance.

(1) Mechanics and Operation*

GNMA mortgage-backed pass-through securities are issued by mortgagees, generally mortgage bankers, who are approved by the Federal Housing Administration (FHA). Prior to issuing the security, a mortgage banker must generate a pool of new individual residential mortgage loans. GNMA requires that all the loans in a pool have the same coupon interest rate and original term to maturity and that each be insured by the FHA or guaranteed by the Veterans Administration (VA). Once GNMA approves the mortgage loans in the pool, the issuer can either sell GNMA securities (i.e., participations in the pool) directly to individual investors or sell the entire issue to a GNMA dealer. Subsequently, the issuer is responsible for servicing the loans in the pool. For providing this service the issuer receives a monthly administration fee of .0367 percent per month (.44 percent per year) of the remaining

*This description is taken from K.B. Dunn and J.J. McConnell, "Valuation of GNMA Mortgage-Backed Securities", Journal of Finance, Vol. 36 (June, 1981), 599-616.

principal balances of the loans in the pool. For guaranteeing the pool GNMA charges a fee of .005 percent per month (.06 percent per year) of the remaining principal balances of the loans in the pool. Thus a GNMA security is issued with an annual coupon interest rate that is .50 percent less than the contract rate on the underlying mortgage loans.

Each month the issuer of a GNMA security must "pass through" the scheduled interest and principal payments on the underlying mortgage loans to the holder of the security, whether or not the issuer has actually collected those payments from the individual mortgagors. Each month the issuer must also pass through any additional mounts which are received from the mortgagors for loan prepayments and/or from the FHA or VA for settlements on those loans in the pool which have been foreclosed. If the security issuer defaults on the monthly payments, GNMA assumes responsibility for the timely payment of principal and interest. Because GNMA monitors the performance of the security issuers and because the securities are backed by the "full faith and credit" of the U.S. Treasury, GNMA pass-through securities are generally considered to be riskless in terms of default.

The mortgage loans which back GNMA securities are fully amortizing. Each of the equal monthly payments on the loans includes interest on the outstanding principal balance and a partial repayment of principal. Because the fee for servicing and guaranteeing the loans is a fixed percentage

of the declining principal of the loans, the scheduled monthly payment to the holders of the security increases slightly through time, approaching the total monthly payment on the underlying loans at maturity.

All FHA and VA mortgage loans can be prepaid (i.e. called by the mortgage borrower) at any time without a prepayment penalty (i.e. without the payment of a call premium). Furthermore, the loans are assumable. That is, the mortgage borrower may transfer his obligation for the debt. Hence, with FHA and VA mortgage loans there are no contractual restrictions which limit mortgagors' call strategies. Thus, when markets are frictionless, mortgagors will exercise their call option only when they can refinance their existing loan with a similar loan that has a lower contract interest rate.

One of the notable characteristics or mortgagors is that, in practice, many of them call their loans even when the market rate is above the contract rate on their existing loans. These prepayments are generally associated with one of the following events: (1) a mortgagor changes his residence and the obligation for the existing mortgage is not assumed by the purchaser of his house; (2) the present house is refinanced so that the owner can withdraw equity; and (3) the mortgagor defaults on his loan.

(2) Rationale for GNMA Mortgage-Backed Securities

The major reasons behind the introduction of GNMA securities appear to be as follows:

1. The mortgage-backed securities were designed to improve liquidity of the secondary mortgage market, by introducing a standardized form of instrument with a guarantee of timely payment of interest and principal.

2. The mortgage-backed securities were to have cash flow, risk and liquidity characteristics which would broaden the appeal of mortgages to potential investors, and thus improve the flow of funds into the mortgage market. This would increase the volume of mortgage funds at a given rate or reduce the interest cost of a given volume of mortgage loans.

3. To the extend that 2. was successful, there would be a net increase in real resources channeled into the housing sector.

4. The role of the GNMA was also deemed necessary in order to reduce start-up costs and to familiarize the market with the instrument. The goal, in part, was to pave the way for the introduction by private issuers of mortgage-backed securities. (The analogy to the introduction of the amortized mortgage by the FHA in the 1930's has been noted.)

In general, there appear to be two major differences in the rationale for the introduction of mortgage-backed securities in Canada relative to the United States.

1. In Canada, their introduction is designed to promote a new mortgage instrument, the 10-year callable mortgage.

2. In Canada, the primary emphasis is on making effective the potential demand for longer-term mortgage loans, not on enhancing the supply of mortgage credit.

If the sole purpose in Canada was to duplicate the advantages initially hypothesized for the United States, then the introduction of mortgage-backed securities in which the underlying mortgages had an initial term of 5 years would be the parallel initiative.

(3) Evaluation of the Success of GNMA Mortgage-Backed Securities

By year-end 1982, over $140 billion of GNMA securities were outstanding, and private firms have issued conventional mortgage-backed, pass-through securities*. The consensus view appears to be that GNMA securities represent a quite successful innovation. The liquidity and marketability of GNMA securities is well established. During the initial year, the stock of outstanding securities was small and trading was thin. The bid-asked spread was about one percent. Spreads have since fallen dramatically and reached 1/32nd of a point by the end of the 1970's.

Evidence on the extent to which the introduction of GNMA securities has increased the net flow of mortgage funds and the allocation of real resources to the housing sector is less clear. On the one hand, there is some evidence to suggest that the improved liquidity of GNMA securities as their market developed served to reduce - other things equal - the spread between GNMA and U.S. Government bonds. This result suggests that there may have been some net downward pressure on mortgage rates. The major problem in evaluating the impact of this initiative on the housing sector is the obvious fact that a given increase in the volume of GNMA pass-through securities cannot be associated with a corresponding net increase in the volume of mortgage credit. A critical review of whatever (and undoubtedly controversial) evidence that exists on this issue is beyond the scope of the

*In 1977, for example, the Bank of America ($150 million) and First Federal Savings and Loan of Chicago ($75 million) issued such securities, which did not have the guarantee of "timely" payment.

present study. The issues relevant to this question are raised, however, in the assessment in Chapter Three of the impact of the alternative initiatives under consideration on the Canadian capital market.

(4) Lessons from the United States Experience

The following observations would appear to be of interest.

1. As the market for mortgage-backed securities developed, liquidity improved and the required yield on these securities - other things equal - fell relative to the yield on U.S. Government bonds.

2. In spite of the call option provided to the mortgage borrowers, which would permit a 30-year mortgage to be called at any time without penalty, thrift institutions and other lenders have been willing to bear this risk, if appropriate compensation is paid. This fact that suggests that it should be possible to entice some participants in the Canadian capital market to bear the risk associated with selling a less valuable option, to call a 10-year mortgage (even without a penalty) after 5 years.

3. Private agents have now issued mortgage-backed, pass-through securities. Although this fact may be of no direct relevance to Canada it does suggest that the "familiarization" objective of CMHC's introducing mortgage-backed securities will in general be of value.

4. The homogeneity of GNMA pools has not only increased their liquidity, but also facilitated the development of a futures market. In turn, this has enhanced the ability of institutions and other agents to manage risk.

5. Retirement and pension funds have become more active in the purchase of GNMA securities.

6. At present, the market for mortgage-backed securities is the fastest growing area among all fixed-income securities*. Estimates are that at least 50 % of the $160 billion in home mortgages to be written this year will be pooled and sold as securities.

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* Business Week, May 23, 1983, pages 160-161.

7. Homebuilders and realtors and several other trade groups now are lobbying for legislative and regulatory changes - embodied in a package called Trusts for Investments in Mortgages (TIMS) - which would give mortgage-backed securities bond-like characteristics, including semi-annual, rather than monthly, payments and prepayment protection. These changes and others contemplated would help broaden the market by allowing issuers to tailor mortgage-backed securities to investors' needs*. The rapid development of this market, together with the willingness to tailor the characteristics to the needs of different investors, both merit note.

3. CMHC Extends Callable Mortgage Loans, Issues Callable Bonds

There appears to be no exact counterpart in the United States to this initiative. FNMA is a major buyer of whole mortgage loans. These mortgage loans are financed by FNMA's issuing bonds (in effect, mortgage-backed bonds). Thus FNMA bears the risk associated with any prepayment privileges (and substantial interest rate risk in other forms**) and does not pass these risks through to the bondholders. If the CMHC considers this direct lending alternative, it would undoubtedly be useful to monitor the underwriting experience of FNMA in this context.

4. Deposit-Taking Institutions Extend Callable Mortgage Loans, Issue Callable Deposits

A salient observation here is that deposit-taking institutions (savings and loan associations) have been active buyers of GNMA pass-through securities, yet have not sought to issue deposits which allow

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*Business Week, May 23, 1983, pages 160-161.

**Traditionally, FNMA has issued short-term bonds to finance its purchase of long-term mortgages, but has been lengthening the term of its debt. FNMA has now begun to issue its own mortgage-backed securities.

the risks associated with the call option to be passed on to depositors. Although our lack of complete familiarity with U.S. institutions requires us to be cautious, the suggestion is that at least some thrift institutions in the U.S. are willing to extend callable mortgage loans (via their decision to purchase GNMA pass-through securities) without issuing callable deposits*.

*The extent to which these institutions try to shed this risk through alternative means, such as activity in the futures market, may merit study. In addition, to the extent that thrift institutions have traditionally been willing to borrow short and lend long, their exposure to interest rate risk on this account may swamp their risk exposure arising from the callable feature of GNMA securities.

III. THE IMPACT OF THE ALTERNATIVE INITIATIVES ON THE CAPITAL MARKET

To the extent that the alternative initiatives impact on the capital market, their effect on the following provides a useful summary measure:

1. the price and quantity of mortgage credit extended;
2. the overall level of interest rates; and
3. the flows of funds through existing financial institutions.

If the alternative initiatives have an important impact on one or more of the above, they may also have an impact on the allocation of real resources between the housing and other sectors.

We find it useful to begin with the following analytical points:

1. None of the initiatives are likely to exert a major impact on the level of domestic saving, since none are directed toward altering the consumption/saving decisions of households. (Empirical evidence suggests that the savings decision of households is not overly sensitive to the rate of return on saving, and any indirect effects that arise from interest rate movements induced by the initiatives can probably be safely ignored.)

2. If the level of domestic saving is unaffected, and ignoring open economy issues, then a net increase in the flow of the saving to the mortgage market must be reflected in a net reduction elsewhere.

3. The fact that Canada is an open economy and that international capital is quite mobile implies (i) greater access to foreign saving is a possible byproduct and (ii) any change in the overall level of interest rates is likely to be dampened by international capital flows.

4. The extent to which there is a shift in the supply schedule for mortgage credit will depend largely on the extent to which any new instrument is (i) attractive to investors and (ii) not a close substitute for existing instruments. (Note that the introduction of a new instrument which is a perfect substitute for an existing instrument will leave the flow of mortgage credit unaffected.)

5. If the initiative is attractive to mortgage borrowers, then this can be represented as a shift in the aggregate demand schedule for mortgage credit.

Using the above analytical points, together with the tools of demand and supply analysis, we can make a number of observations.

1. Mortgage Rate Insurance

The "financing" of this initiative requires the sale by the Government of a call option, embedded in a 10-year bond that is callable after 5 years. There will be an increase in gross borrowing by the Government, but net borrowing will be unchanged. There is no reason that the effective supply schedule of mortgage credit will shift rightward. To the extent that at least some mortgage borrowers find the 10-year callable mortgage* a more attractive instrument (after paying the market price of the call option), there will be a rightward shift in the aggregate demand for mortgage credit. The net result will be an increase in the price (i.e., "The" mortgage rate) and in the quantity of mortgage credit extended (Figure 3.1). The magnitude of these increases will reflect the size of the effective increase in the demand for mortgage credit arising from the introduction of the 10-year callable mortgage. Unfortunately, at this time, it is not possible to obtain an accurate estimate of either the location or the elasticity of this demand schedule.

The rise in "the" mortgage rate relative to other interest rates will be required to attract domestic saving (presumably) from alternative uses. Any rise in the overall level of interest rates will be dampened,

*Remember that the sale of mortgage rate insurance, in effect, provides the borrower with a 10-year callable mortgage (and conversely).

however, by the inflow of capital from abroad. In effect, there is likely to be an increase in foreign saving to offset the reduced access of other sectors to domestic saving. Unless the effective increase in mortgage demand is quite large, all of the aforementioned effects are likely to be of modest magnitude.

Because the Government is simply selling insurance, there is not likely to be any major change in the flow of the funds through existing mortgage-lending institutions. To the extent that the Bank of Canada keeps the size of the banking system constant (by adhering to a fixed target for M2*), any net increase in mortgage lending by banks will be offset by a net reduction in lending elsewhere. In this scneario, however, there could well be an increase in the borrowing and mortgage-lending activities of trust and mortgage loan companies.

2. Mortgage-Backed, Pass Through Securities

Although mortgage borrowers will have to compensate the holders of these securities for bearing the risk associated with the call option, there is likely to be a net rightward shift in the supply schedule for mortgage credit. Because the securities will have liquidity and other features not presently available to actual or potential mortgage lenders, they do not simply replicate (abstracting from the call feature) existing financial instruments. If there is the hypothesized rightward shift in the demand schedule for mortgage credit, then the quantity of mortgage credit extended will increase, and by more than in the mortgage rate insurance initiative. The change in the price of mortgage credit (again,

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*M2, one of the money aggregates that is a possible target for monetary policy, consists of currency plus all deposits of the chartered banks.

"the" mortgage rate) will be ambiguous (Figure 3.1).

The shift in domestic saving toward the mortgage market implies a (larger) reduction in the access of other sectors to this pool of saving. As a consequence, other interest rates will unambiguously be bid up. Again, however, any increase in the overall level of interest rates will be tempered by an inflow of capital from abroad.

The impact of this initiative on the flow of funds through existing financial institutions is more difficult to predict. At one extreme, if only private individuals and institutions at present inactive in the mortgage market purchase the mortgage-backed securities, then the net mortgage lending by existing institutional lenders is likely to fall*. This scenario is probably unrealistic, however, as the existing lending institutions - especially trust and mortgage loan companies - would have a strong incentive either to purchase the mortgage-backed securities or to innovate along parallel lines. Although all comments must remain speculative, it would appear that if mortgage-backed securities prove to be successful (as they have in the United States), there will be great pressure on institutions which specialize in mortgage lending to participate in this market. They might, for example, purchase the mortgage-backed securities and either (1) innovate by issuing callable deposits (or shedding the risk in some other fashion) or (2) assuming the attendant interest rate risk.

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*If, counterfactually, there were no net increase in mortgage credit extended, then the mortgage lending by these institutions would fall dollar-for-dollar with the issue of mortgage-backed securities.

3. CMHC Extends Callable Mortgage Loans, Issues Callable Bonds

In this case, there will be no rightward shift in the supply schedule for mortgage funds. Except for the call option, for which bondholders must be compensated, the debt instrument used to finance the mortgage loans is identical to an existing financial instrument. There will be no increase in investors attracted, indirectly, to the mortgage market on this account. If the CMHC prices its mortgage loans at market (i.e. the straight 5-year mortgage rate plus the estimated value of the option), then the effective increase in the demand for mortgage credit will be the same as in the two previous cases. As a result, there will be a rise in both the price and quantity extended of mortgage credit that is exactly equal to that in the case in which mortgage rate insurance is introduced (Figure 3.1).

As always, international capital flows will contain any rise in the overall level of interest rates, and the remarks in the discussion of mortgage rate insurance apply here as well.

The impact of this initiative on the flow of funds through private lending institutions is potentially important. If, counterfactually, there were no net increase in mortgage credit extended, there would be a dollar-for-dollar reduction in net mortgage lending emanating from private lenders. Again, there would be pressure - especially on institutions which specialize in mortgage lending - to innovate in a parallel fashion. If CMHC were pricing its 10-year callable mortgages at a market rate, then it would be possible for private lending institutions to introduce a parallel initiative. There would still remain the problem that the holders of the deposit claims of these institutions are likely to be more

risk averse than those who purchase primary securities directly. If so, these institutions might be required - in effect - to bear at least some of the interest rate risk themselves.

4. Financial Institutions Extend Callable Mortgage Loans, Issue Callable Deposits

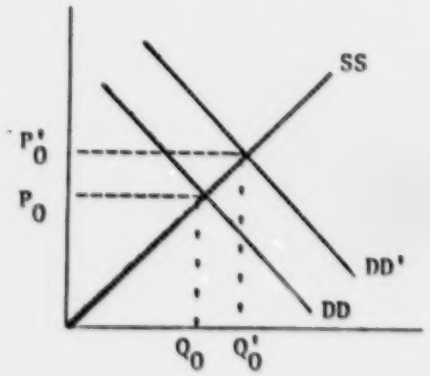
In this instance, it is probably reasonable to assume that there will be no rightward shift in the supply schedule of mortgage funds. This is due to the fact that, absent the call option, the deposits are perfect substitutes for existing instruments. If the price of the call option is relatively expensive, reflecting the possible risk aversion of typical depositors, then the effective rightward shift in the demand for mortgage credit will be smaller than in any of the previous cases. (This is because mortgage borrowers will have to pay a higher price for the same call option.) The result will be a (modestly) smaller rise in both the price and quantity extended of mortgage credit (Figure 3.1). The usual remarks regarding movements in the overall level of interest rates and possible increased reliance on foreign saving continue to apply.

In this case, any net increase in mortgage lending (and borrowing to finance this lending) emanates from traditional mortgage-lending institutions. If the Bank of Canada adheres to a fixed target for M2, any net increase in mortgage lending by the banks will again be at the expense of reduced lending elsewhere.

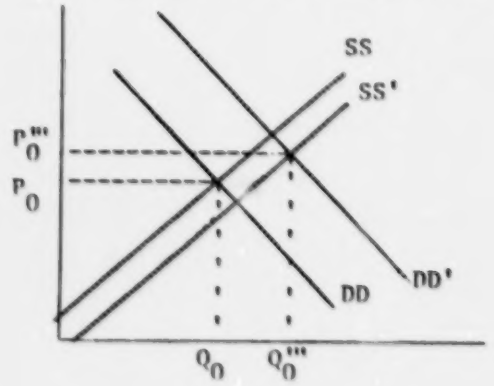
Figure 3.1

Impact on Price and Quantity Extended of Mortgage Credit: the Alternative Initiatives

Mortgage Rate Insurance



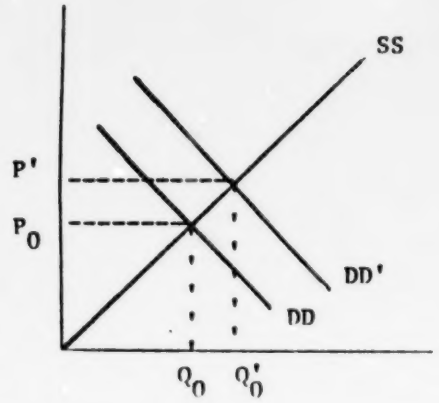
Mortgage-Backed, Pass Through Securities



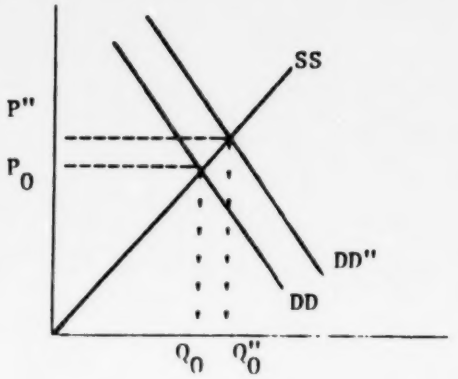
Note: $Q'''_0 - Q_0 > Q'_0 - Q_0$

$P'''_0 - P_0 \geq 0$

Direct CMHC Lending



Institutions Issue Callable Deposits, Grant Callable Mortgages



Note: $P'' - P_0 < P' - P_0$

$Q'' - Q_0 < Q' - Q_0$

Note: An increase in price corresponds to an increase in "the" mortgage rate.

Overview

At present, with the Canadian economy operating at less than full capacity, any net increase in mortgage lending and consequent increase in housing activity need not draw real resources away from other sectors. In the long run, any effective increase in the demand for the stock of housing will lead to a reallocation of real resources away from other sectors of the economy.

In terms of the net stimulus to the housing sector, the mortgage-backed securities would have the largest effect. Only in this case is there likely to be a positive impact on the supply of mortgage funds. In all cases, since the level of domestic saving is likely to be unaffected, any net increase in extension of mortgage credit must lead to some overall rise in the level of interest rates (as a rationing device) and/or an increased access to foreign saving. In fact, both are likely to occur, with international capital flows limiting any increase in the overall level of interest rates.

Finally, the qualitative analysis contained in this chapter is fairly straightforward. The quantitative analysis keys on the "latent demand" for 10-year callable mortgages, which - as discussed in Chapter One - is very difficult to estimate.

IV. MORTGAGE-BACKED SECURITIES: THE PERSPECTIVE FROM MODERN FINANCE THEORY

A mortgage-backed security (MBS), as previously defined, is an instrument with collateral of a pool of homogeneous default insured mortgages. The interest and principal payments on the underlying mortgage loans are passed on to the holders of the MBS. A Government agency guarantees to the holders of such securities the timely payment of the interest and principal payments. The home owners, who took out the underlying mortgage loans, have the option to make, at any time, principal prepayments.

To simplify the discussion it will be assumed that there is only one underlying mortgage loan. Holding a MBS is similar to holding a callable bond apart from one technicality. For a callable bond it is the issuer who has the option to call the bond; for a MBS, the home owner with the mortgage loan and not the originator has the option to call the MBS. Hence, at any point in time, the market value of the MBS can be decomposed into two components: the market value of the identical mortgage without a call feature less the market value of a call option. If interest rates increase (decrease) the market value of the identical mortgage without a call feature will decrease (increase) and so will the value of the call option, which acts to reduce the change in the market value of the MBS. Consequently, changes in the price of the MBS are less volatile than price changes of the identical mortgage without a call feature. Because unanticipated changes in interest rates represent a risk that cannot readily be diversified, the required rate of return on the MBS will not be greater

than the required rate of return on the identical mortgage without a call feature. Indeed, the required rate of return may well be less.

Given the practice of issuing instruments at par, then the mortgage rate (or in the case of a bond, the coupon) on the MBS will have to be greater than the mortgage rate on the mortgage without the call feature, assuming that the call feature has positive value. In the light of the above argument regarding their exposure to interest rate risk, the difference in the mortgage rates cannot be interpreted as implying that MBS's are "more expensive" than a mortgage without the call feature. If investors are willing to hold MBS's at a lower equilibrium return, then the correct inference is that the expected cost of MBS's is less than the expected cost of otherwise identical securities which lack the call option.

Call Feature

From modern option theory, a number of properties of the call option associated with MBS's can be immediately stated. As uncertainty about future interest rates decreases, the value of the call option decreases. The value of the call option will also decrease, ceteris paribus, as the maturity of the MBS decreases. Consequently, if MBS's of different maturities are issued then, as the maturity increases, the value of the call option increases, and for the instruments to be issued at par, the mortgage rate (or, with a bond, the coupon) on a particular instrument will be an increasing function of maturity.

Prepayment

A MBS allows the home owner who takes out the underlying mortgage loan to prepay the mortgage at any point in time without penalty*. If mortgage rates drop, then the rational home owner should call the mortgage and negotiate a new mortgage. In practice, although there are no penalty costs, transactions costs will be incurred in the renegotiation. It is observed, at least in the U.S.A.**, that some home owners prepay their mortgages even when mortgage rates go up. If such behaviour is purely random, then this should not affect the required rate of return on MBS's, as such risk can be diversified.***

Sinking Funds

Prepayment privileges allow the home owner who takes out a mortgage to reduce the level and risk associated with mortgage payments. The provision of prepayment privileges affects a shifting of risk from the borrower to the lender. For the financial institution investing in MBS's, the prepayment privileges associated with such securities exposes it to the risk of a possible mismatching of assets and liabilities. The financial institution can substantially reduce its risk exposure, if it desires, by issuing its own liabilities with a call feature. However, given that prepayments can occur for reasons other than declines in mortgage rates, the financial institution will still be exposed to risk. It can reduce this risk by having sinking requirements on its own financial obligations.

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*Note, of course, that this need not be the case. It is, for example, the case with GNMA pass-through securities in the United States.

**See K.B. Dunn and J.J. McConnell, "Valuation of GNMA Mortgage-Backed Securities", Journal of Finance, Vol. 36 (June, 1981), 599-616.

***It will be shown in Table 4.4 that prepayment can in fact lower the expected rate of return. The reason for this apparent contradiction is given on p. 4-8.

Amortization

The effects of amortization are illustrated in Table 4.1. It is seen that if interest rates go above the coupon rate of 12 percent the amortized bond is worth more than the non-amortized bond. This is because the cash flows from the amortized bond are always greater than those from the non-amortized bond until maturity, when the total principal of the non-amortized bond is repaid. When the current interest rate is greater than the contract rate on the securities, the final payment on the non-amortized bond is severely discounted so that the amortized bond is worth more than the non-amortized bond.

The differing effects of amortization will affect the value of the call option associated with MBS's. When the amortized and non-amortized bonds are selling at a discount, the amortized bond is always worth more. As the call option prevents a callable security from selling at a premium, an amortized callable security is more valuable than an otherwise identical non-amortized callable security. If the instruments are issued at par, then the mortgage rate on the amortized, callable security will be less than the coupon on the non-amortized, callable security.

Rates of Return on GNMA Securities

The required or expected rate of return on a MBS should not be greater than the return on the identical security without a call feature. Dunn and McConnell* have compared the realized rates of return on GNMA

*K.B. Dunn and J.J. McConnell, "Rates of Return on GNMA Securities: The Cost of Mortgage Funds", Journal of American Real Estate and Urban Economics Association, Vol. 8 (1980), 320-36.

securities with the returns on long-term Government and Aaa-rated corporate bonds*. They found that the mean average monthly returns on GNMA securities was greater than the returns on long-term Government and Aaa-rated corporate bonds over the period 1971:1 to 1978:6, though the differences were not statistically significant. The results are reproduced in Table 4.2. Statistical insignificance not withstanding, the fact that the mean return on GNMA securities was greater than long-term Government and Aaa-rates corporate bonds merits comment.

There are a number of observations to be made. First, over the time period of the study interest rates were generally increasing. The study considered GNMA securities with an 8 percent coupon. As shown in Table 4.1, if interest rates are above this coupon rate, then an amortized security is less volatile than a non-amortized security with the same coupon rate and maturity. Hence, in a period, where long-term interest rates were rising, ex post returns on GNMA securities will, on average, be greater than the returns on similar, but non-amortized securities. Secondly, given the general increase in interest rates, the call option associated with GNMA securities would be of little value. Hence the main factor affecting the relative values of the securities will be the amortization feature. Thirdly, to use ex post data to make inferences about expected or ex ante returns requires the assumption of stationarity. Given the time period of the study, such an assumption is moot. Fourthly, and especially at the beginning of the authors' sample period, GNMA securities were far less liquid than long-term Government bonds. This should have caused the GNMA securities to

*It should be noted that corporate bonds usually have a call option, exercisable at the discretion of the borrower.

be priced to yield a higher expected return on this account.

Given the result that the differences in the rates of returns were statistically insignificant, the study does underline the importance of not using coupon rates to make inferences about the relative cost of GNMA securities.

The Pricing of MB Securities

As MBS's have a call option feature, modern option theory can be used to price such securities. Dunn and McConnell* have undertaken such a task. Their model is described and some of their results presented, as it illustrates how such factors as amortization, callability, and the prepayment of principal for reasons other than decreases in mortgage rates (they term such payments as "suboptimal prepayments") affect the value of a security.

The key assumptions of their model are that interest rates, which change stochastically over time, have some long-run equilibrium value. The short-term interest rate is assumed to be the key variable which causes changes in the term structure. Suboptimal prepayments are assumed to occur randomly over time. The parameters of the stochastic process describing such prepayments are estimated from the experience of the Federal Housing Administration (FHA). Some results from their model are shown in Table 4.3**. The short-term rate, column 1, determines the whole term structure. The market value of a callable bond can never go above its call price of $100. Given the assumptions of the term structure,

*K.B. Dunn and J.J. McConnell, "Valuation of GNMA Mortgage-Backed Securities", Journal of Finance, Vol. 36 (June, 1981), 599-616.

**Table 4.3 is reproduced from Table 1, Dunn and Mc Connell (1981).

if the short term rate is 8 percent, the non-amortized, non-callable bond will be approximately trading at par (see column 3). For the identical instrument but with a call feature, its market value will be less than par, because of the value of the call option. The callable instrument will only start to trade at par when the short-term rate is between 4 and 5 percent (see column 4). The GNMA securities will only start to trade at par when the short-term rate is between 5 and 6 percent*.

In comparing columns 3 and 4, the non-callable bond is always worth more than the callable bond, the difference being the value of the call option. The effects of amortization, already explained in Table 4.1, can be seen by comparing columns 3 and 5. By comparing columns 5 and 6, it is seen that the call feature, as to be expected, lowers the value of the security. Columns 6, 7, and 8, show that the effect of suboptimal prepayment is to increase the value of the security, as suboptimal prepayments benefit the lender.

The expected rates of return for the different instruments can be determined and these are shown in Table 4.4. The effect of the call feature in reducing the risk is shown in columns 3 and 4; the required or expected rate of return on the callable bond is less than the expected rate of return on the non-callable bond. The ambiguous effect of amortization is seen in columns 3 and 5. If the short-term rate is below (above) the coupon rate, then the amortized bond is more (less) volatile (see Table 4.1) and its expected rate of return is greater (less) than the expected rate of return on the identical but non-amortized bond. The effect of suboptimal prepayments is seen by comparing columns 7 and 8 with column 6. It is seen that the effect of suboptimal prepayments is

*If the practice of issuing securities at par was implemented, then the coupon rates on the various instruments would differ.

to lower the risk and hence the expected rate of return. At first glance, this is a surprising result for such payments are not systematically related to interest rates and thus do not affect the systematic risk. However, the suboptimal prepayments reduce the sensitivity of the cash flows of the GNMA security to changes in the interest rate, and this lowers the risk of the security. This observation is quite important in view of the tax incentives in Canada, which encourage individuals to prepay their mortgages so long as the before-tax cost of their mortgages exceeds the after-tax return on prospective investments. While such a model is useful in examining the potential effects of different features upon the value of a security, no evidence is available to indicate the empirical accuracy of the model*.

*A comparison of different valuation models is given in K.B. Dunn and J.J. McConnell, "A Comparison of Alternative Models for Pricing GNMA Mortgage-Backed Securities", Journal of Finance, Vol. 36 (May, 1981), 471-84. Again, no evidence is given to show the accuracy of the models in predicting prices.

Table 4.1

Prices of Fixed Rate Securities as a Function of the Current Interest Rate when the Coupon Rate on the Bonds is 12% and the Term to Maturity is 25 Years

Long-Term Interest Rate (Percent)	Market Value Non-amortized Non-callable Bond $	Market Value of Amortized Non-callable Bond $
10	118.12	115.73
12	100.00	100.00
14	86.28	87.63
16	75.56	77.73

Table 4.2

Summary Statistics for Monthly Rates of Return on GNMA Securities, Government Bonds, and Aaa-Rated Corporate Bonds

Months[a]	Arithmetic Mean	Standard Deviation	Maximum	Minimum	Studentized Range
GNMA Equally-weighted Index (all data)					
1-90	.00558	.01836	.0634	-.0336	5.446
31-90	.00538	.02097	.0634	-.0336	4.769
GNMA Value-weighted Index (all data)					
1-90	.00557	.01837	.0634	-.0372	5.476
31-90	.00538	.02097	.0634	-.0372	4.797
GNMA New-Issues Equally-weighted Index (14 months only)					
1-90	.00552	.01839	.0633	-.0373	5.470
31-90	.00528	.02100	.0633	-.0373	4.790
GNMA New-Issues Value-weighted Index (14 months only)					
1-90	.00552	.01839	.0633	-.0341	5.470
31-90	.00528	.02100	.0633	-.0341	4.790
Long-Term Government Bonds					
1-90	.00494	.02047	.0526	-.0468	4.856
31-90	.00482	.02024	.0489	-.0433	4.555
Long-Term Aaa Corporate Bonds					
1-90	.00546	.02221	.0596	-.0476	4.827
31-90	.00523	.02370	.0596	-.0476	4.523

[a]Months	Time Period
1-90	1/1971-6/1978
31-90	7/1973-6/1978

Table 4.3

Prices of Various Fixed-rate Securities as a Function of the Current Interest Rate when the Coupon Rate is 8 Percent and the Term to Maturity is 30 Years

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Percentage Current Interest Rate	Percentage 30 Year Interest Rate	Non-amortized Non-callable Bond	Non-amortized Callable Bond	Amortized Non-callable Bond	GNMA Security with the Optimal Call Policy	GNMA Security with Suboptimal Prepayments at 100% of FHA Experience	GNMA Security with Suboptimal Prepayments at 200% of FHA Experience
0.0000	7.5268	113.29805	100.00000	113.11888	100.00000	100.00000	100.00000
1.0000	7.5863	111.52800	100.00000	111.37348	100.00000	100.00000	100.00000
2.0000	7.6459	109.78614	100.00000	109.65568	100.00000	100.00000	100.00000
3.0000	7.7054	108.07378	100.00000	107.96676	100.00000	100.00000	100.00000
4.0000	7.7649	106.38961	100.00000	106.30542	100.00000	100.00000	100.00000
5.0000	7.8244	104.73284	99.98574	104.67093	100.00000	100.00000	100.00000
6.0000	7.8840	103.10400	99.27023	103.06378	99.37159	99.62100	99.75924
7.0000	7.9435	101.50229	98.13678	101.48319	98.29127	98.69237	98.92891
8.0000	8.0030	99.92686	96.85764	99.92836	97.05001	97.55658	97.86710
9.0000	8.0625	98.37738	95.51956	98.39893	95.74209	96.33082	96.70242
10.0000	8.1221	96.85347	94.15900	96.89456	94.40717	95.06459	95.48951
11.0000	8.1816	95.35476	92.79359	95.41488	93.06444	93.78187	94.25497
12.0000	8.2411	93.88086	91.43269	93.95950	91.72411	92.49552	93.01308
13.0000	8.3006	92.43135	90.08169	92.52803	90.39207	91.21296	91.77215
14.0000	8.3602	91.00581	88.74380	91.12006	89.07187	89.93871	90.53723
15.0000	8.4197	89.60381	87.42101	89.73514	87.76572	88.67562	89.31155
16.0000	8.4792	88.22487	86.11456	88.37284	86.47499	87.42552	88.09717
17.0000	8.5387	86.86852	84.82519	87.03268	85.20054	86.18959	86.89548
19.0000	8.5982	85.53428	83.55332	85.71419	83.94289	84.96857	85.70734
20.0000	8.6578	84.22222	82.29961	84.41745	82.70275	83.76333	84.53372

Table 4.4

Expected Rates of Return for Various Fixed-rate Securities as a Function of the Current Interest Rate When the Coupon Rate of the Bonds is 8 Percent and the Term to Maturity is 30 Years

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Percentage Current Interest Rate	Percentage 30 Year Interest Rate	Non-amortized Non-callable Bond	Non-amortized Callable Bond	Amortized Non-callable Bond	GNMA Security with the Optimal Call Option	GNMA Security with Suboptimal Prepayments at 100% of FHA Experience	GNMA Security with Suboptimal Prepayments at 200% of FHA Experience
6.00	7.8840	8.232	7.474	8.291	7.373	7.081	6.902
8.00	8.0030	11.089	10.683	11.049	10.609	10.409	10.274
12.00	8.2411	16.615	16.397	16.553	16.320	16.118	15.958

V. THE GENERAL PROBLEM OF RISK BEARING (OR "WHO WILL HOLD THE CALLABLE DEBT INSTRUMENTS?")

Introduction

If mortgage borrowers are to have - either directly or through the vehicle of mortgage payment insurance - 10-year, callable mortgages, then some other individuals or institutions must be persuaded to sell the required call options. The question, "Who will hold the callable debt instruments?", is inevitably raised in any discussion of these possible initiatives. As noted in Chapter One, this issue is best re-phrased in terms of the problem of identifying the price that agents will require for selling this option, and how this price will vary with the quantity bought and sold in the marketplace. This chapter addresses the following specific issues.

1. What information can be extracted from the Canadian capital market regarding the pricing of this or related options?
2. What information can be extracted from the U.S. experience with GNMA mortgage-backed, pass-through securities?
3. Who are the participants in the Canadian capital market who are willing to bear this risk at the least cost?
4. To what extent would (i) call premiums or (ii) sinking funds serve to reduce the risk to the holder of the callable instrument, and thus the price of the call option?

1. The Pricing of Existing Options in the Canadian Capital Market

The 10-year mortgage that is callable after 5 years at the borrower's option gives the holder of the instrument the equivalent of:

(1) a straight 5-year mortgage less a put option; or

(2) a straight 10-year mortgage less a call option.

These facts are spelled out in an earlier study* and need be developed no further here. The holder of the 10-year, callable mortgage must be paid the rate on a straight 10-year mortgage plus the amortized value of the call option. Equivalently, the holder of the 10-year, callable mortgage must be paid the rate on a straight 5-year mortgage plus the amortized value of the put option. Since straight 10-year mortgages do not exist and the straight 10-year rate is not observable, it is most useful to focus on the comparison with the straight 5-year mortgage. At the same time, it is important to recognize that most practitioners will prefer to think of the new instrument as a 10-year, callable mortgage rather than a 5-year, extendible mortgage, with the extendible feature corresponding to a put option.

Assuming that the put option associated with a 5-year mortgage extendible at the borrower's option for 5-years is equivalent to that on a 5-year Government bond extendible for 5 years at the issuer's option**, we can make the following observations:

(1) the put option will become more valuable as the slope of the term structure steepens and/or as the degree of uncertainty regarding future rates increases***:

(2) the value of the put option will vary over time, and hence the spread between the 10-year, callable mortgage and the straight 5-year mortgage rate will vary over time;

(3) at present, the amortized value of this put option is likely to correspond to a yield premium of about 100 basis points, due to the relatively steep slope of the term structure at present;

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* J. Pesando and S.M. Turnbull, "The Pricing and Reception of Bonds Extendible at the Option of the Government of Canada". Study prepared for CMHC, 13 May 1983.

** As noted in Appendix A, this will be only "proximitely" true.

*** Relative to a straight 10-year mortgage, the value of the call option will rise as the slope of the term structure decreases and/or as the degree of uncertainty regarding future rates increases.

(4) since the 5-year mortgage rate is now 13%, this implies that the present rate on a 10-year, callable mortgage would be in the vicinity of 14%; and

(5) historical data (on 5-year Government of Canada bonds extendible for an additional 5 years at the holder's option relative to straight 10-year Government of Canada bonds) suggest that the yield premium on the 10-year, callable versus straight 5-year mortgages might be expected to average in the vicinity of 50 basis points.

The estimate that 10-year callable mortgages would require, at present, a 100 basis point premium over straight 5-year mortgages is subject to two important caveats:

(1) Pesando-Turnbull derive their estimates by explicitly assuming that options are priced symmetrically regardless of whether they are held by the issuer or the lender (which, in fact, appears to be the implicit assumption of the institutional respondents in the earlier study); and

(2) no explicit attention was given to the volume question, and hence to the question of how the price of this option might rise as the demand for 10-year, callable mortgages increased.

The first caveat is discussed explicitly in the earlier study and merits no additional comment. The second question was not explicitly addressed, however, and merits additional comment.

Neither Pesando-Turnbull in their analysis of outstanding bonds, nor the respondents to their questionnaire, explicitly considered this issue. Implicitly, both could be interpreted as suggesting - in the context of the 10-year, callable mortgage - that the supply schedule for the call option is perfectly elastic over some range. In fact, if the "latent" demand for 10-year, callable mortgages is large (in that the quantity demanded at a zero price is quite large), then the assumption of a perfectly elastic supply schedule is probably not very realistic. This fact has already been illustrated in Chapter One. Unfortunately,

any attempt to go beyond this observation would be - based on our present information - purely speculative.

2. The Experience in the U.S. with GNMA Mortgage-Backed, Pass-Through Securities

The FHA mortgages that constitute these pools are mortgages which have an initial maturity of 30 years and which can be prepaid, at any time and without penalty. This option is of far greater value than the call option in the proposed 10-year, callable mortgages. These mortgages would be callable only after 5 years, and the reduction in the term to maturity would be 5 years, not (a theoretical maximum of) 30 years.

Recent data on the spread between near-par GNMA securities and 30-year U.S. Treasury bonds are presented in Table 5.1. As noted by many commentators in the United States, this spread rose dramatically when interest rates reached their peak in the latter half of 1981. For all of 1981, the spread averaged 185 basis points, far above the average spread of 49 basis points in 1978. Researchers have sought to explain the rise in this spread, with most recognizing that the increased value of the call option is the key factor. In a representative paper, Hendershott et. al.* conclude that the major source of the increase in this spread is the increased value of the call option**. In view of the facts that (1) mortgage rates had reached historical highs that dramatically exceeded previous record levels and (2) the consensus among financial analysts was that the uncertainty regarding the interest rate outlook was also perhaps at an all-time high, this result is not surprising.

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*P. Hendershott et. al. "The Determination of Home Mortgage Rates: Empirical Results for the 1975-1981 Period". Paper presented to the American Finance Association, New York, 29 December 1982.

**Like most U.S. analysts, who treat GNMA securities on having an effective maturity of about 12 years, these authors focused on the comparison between the yield on near-par GNMA securities and 10-year Treasury bonds, uet 30-year Treasury bonds. Conceptually, this is a major limitation of this and similar studies.

For our purposes, two facts stand out:

(1) in spite of the aforementioned factors, which suggest that interest rate risk was very large, investors were willing to purchase GNMA securities; and

(2) perhaps surprisingly, the maximum spread was only 250 basis points (August 1981).

Point (2) merits some elaboration. We estimate at present that the 10-year, callable mortgage in Canada would command a yield premium of about 100 basis points over a straight 5-year mortgage to compensate the holder for a far less valuable call option. The option associated with a Gimmie Mae can be exercised anytime over a 30-year period. The option for the 10-year callable mortgage in Canada can only be exercised at year 5. To provide some estimates of the differences in the values of options differing only in maturity, some results from a published study* are shown in Table 5.2. It is assumed that the current short-term rate is 12% and given the assumptions of the model, this implies a downward sloping term structure - see column 2. The values of two non-amortized bonds are compared in columns 3 and 4, and the dollar value of the associated call option is given in column 5. The dollar value of a call option with a maturity of 5 years is $1.103 and with a maturity of 30 years is $2.448, an increase of over 121%. In columns 6 and 7 the market value of amortized securities are shown and the dollar value of the associated call option is given in column 8. Again the dollar value of the 30-year option is far greater than the value of the 5-year option.

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* See K.B. Dunn and J.J. McConnel, "Valuation of GNMA Mortgage-Backed Securities", Journal of Finance, Vol. 36 (June 1981), 599-616. A description of this model is given in Chapter 4.

In both cases the options are American, implying they can be exercised at any time. The option associated with the 10-year, callable mortgage is a European option, implying that it can only be exercised at one point in time, at year 5. An American option is always worth more than a European option, if it is expected to be optimal to prematurely exercise the option. Given that mortgage payments must be made on a regular basis, in general, it will be in the interests of a mortgage borrower to prematurely exercise such an option. Hence the figures presented in Table 5.1 overestimate the value of a European call option. We also know from Chapter Four that prepayments not linked to interest rate movements serve to reduce the required return on GNMA securities. This fact should be reflected, other things equal, in a lower yield spread than if such prepayments did not occur*. Because of the fact that mortgage interest payments are not tax deductible in Canada, there is a stronger a priori case for prepayments not motivated by interest rate movements in Canada than in the United States. This factor should serve to reduce the spread between the yield on 10-year, callable mortgages and straight 5-year mortgages relative to the case in which such prepayments did not occur. The self-amortizing feature of GNMA securities versus non-amortizing bonds should also reduce their required return and thus the spread between these two rates, as also discussed in Chapter Four.

In short, there are factors which serve to make the rate spread between GMNA securities and 30-year Treasury bonds a downwardly biased

*Again, as emphasized in Chapter 4, reported yield spreads should not be used as a rough proxy for expected returns. In equilibrium, the expected return on GNMA securities could well be less than that on 30-year Treasury bonds.

estimate of the amortized value of the call option*. This fact notwithstanding, the experience of GNMA securities in the United States must be viewed as favourable. We are willing to conjecture that the yield premium required in Canada on 10-year, callable relative to 5-year mortgages is not likely to exceed - under the least favourable circumstances - 125-150 basis points.

3. Prospective Holders of 10-Year, Callable Debt Instruments in Canada

In order to obtain a feel for the type of investor who might be willing to hold 10-year, callable debt instruments (and thus bear the interest rate risk associated with the sale of the call option), it is instructive to list the characteristics of these instruments. For analytical purposes, it is convenient to focus attention on the case in which the relevant instrument is a mortgage-backed, pass-through security similar to GNMA securities. The following observations merit note.

1. To compensate the holder for the value of the call option, these securities will trade at a yield premium. This fact suggests that they will have a natural "tax clientele" consisting of tax-exempt investors.

2. Since the securities will pay monthly income (consisting of interest, amortization of principal, and my prepayments), they will appeal on this account to investors whose objective is to generate a steady cash flow from their portfolios.

3. Because the holders of these securities will bear the interest rate risk associated with the sale of the call option, the instruments may not be attractive to financial institutions who wish to match the maturity of their assets with the maturity of their liabilities (unless, of course, these institutions innovate in a parallel fashion on the liability side of their balance sheets).

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*The fact that this spread has changed over time also illustrates the fact that the price of the call option will vary over time. In turn, this implies that the market price of the premium for mortgage rate/payment insurance must also vary over time.

4. Because of the self-amortizing feature, the existence of "random" prepayments, and the call option itself, the price of these instruments will be less volatile than the price of straight 10-year bonds. This feature may be attractive to some investors, since they will be able (for example) to sell them at a smaller loss should interest rates unexpectedly rise than would occur with straight 10-year bonds.

5. Because of the maximum maturity of 10 years, and in view of the fact that their prices will be less volatile than on straight 10-year bonds, these instruments are not likely to appeal to investors with short investment horizons, including speculators.

The first two points suggest strongly that pension funds, individuals with RRSP's, and those who are annuitizing accumulated pension saving are likely to be potential purchasers of the callable debt instruments. The third point suggests that the instruments may not be attractive to financial institutions such as banks, trust and mortgage loan companies. This observation does, however, merit a number of caveats. These institutions may innovate on the liability side, may decide to bear the interest rate risk, or may - especially if futures and/or options markets develop - seek to reduce their risk in other ways. The fourth point will be irrelevant to those who will always hold the instruments to maturity, but may enhance their attractiveness to those who purchase them for income but recognize that they might have to sell them before maturity. The fifth point highlights, again, their potential attractiveness to investors - such as pension funds - with longer-term investment horizons. Of particular note is their potential attractiveness to individuals who set up RPA's* (essentially, locked-in RRSP's), if they are introduced, with the locking-in feature serving to lengthen the effective investment horizon of the investor.

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*See Chapter One, page 1-11.

4. The Extent to Which Call Premiums and/or Sinking Funds Might Enhance the Attractiveness of Callable Debt Instruments

When bonds are issued with call provisions, they are typically callable after a certain date and at a premium over their par value. This premium may decline over time after the earliest call date. In effect, the striking price of the call option is increased, which reduces its value and thus the required yield premium which represents its amortized value. In the present context, it would be possible to issue 10-year, callable bonds which, if called after 5 years, would be so at a premium over their issue price. This could be accomplished, for example, by specifying a redemption value for the mortgages if called after 5 years which would be in excess of their then amortized value. The yield premium required when this same feature is passed through to the ultimate purchasers of the callable debt instruments would thus be reduced, although - of course - the holder of the callable debt instrument would continue to bear (less) interest rate risk.

If a financial institution were to issue 10-year, callable mortgages, it might choose not to shed the risk to itself by issuing 10-year, callable deposits. The financial institution might instead elect to issue straight 10-year deposits, but with a sinking fund which would allow the institution (say) to retire up to 20% of the debt issue each year after the fifth year. This might make the liabilities of the financial institution more attractive to investors, while reducing the risk exposure faced by the institution. The institution would make its decision on how much debt to retire on the basis of its prepayment experience, thus bearing reinvestment risk in the interim. The fact

that some prepayments would occur "randomly" would reduce the reinvestment risk borne by the financial institution relative to the case in which no such prepayments occurred.

As noted in Chapter Three, there is considerable interest in the United States in mortgage-backed securities. Attention is now being devoted to the problem of tailoring their features to make them attractive to investors with different needs or preferences. It might be possible, for example, to issue two types of mortgage-backed securities against a given pool of mortgages. One type of security could be designed to bear most of the uncertainty regarding prepayments, through the design of an appropriate formula. This would represent a "fast pass-through" security, while the other would be a "slow pass-through" security. In general, monitoring the evolving situation in the United States should prove very valuable on this account.

Table 5.1

Yield on GNMA Securities versus 30-Year U.S. Treasury Bonds

		Yield on GNMA*	Yield on Treasury Bonds**	Spread
1978		8.98	8.49	0.49
1979		10.22	9.29	0.93
1980		12.55	11.30	1.25
1981		15.29	13.44	1.85
1981	January	13.50	12.14	1.36
	February	14.13	12.80	1.33
	March	14.22	12.69	1.53
	April	14.69	13.20	1.49
	May	15.31	13.60	1.71
	June	15.02	12.96	2.06
	July	15.76	13.59	2.17
	August	16.67	14.17	2.50
	September	17.06	14.67	2.39
	October	16.54	14.68	1.86
	November	15.10	13.35	1.75
	December	15.51	13.45	2.06
1982	January	16.19	14.22	1.97
	February	16.21	14.22	1.99
	March	15.54	13.53	2.01
	April	15.40	13.37	2.03
	May	15.30	13.24	2.06
	June	15.84	13.92	1.92
	July	15.56	13.55	2.01
	August	14.51	12.77	1.74
	September	13.52	12.07	1.45
	October	12.83	11.17	1.66

*Average net yields to investors on Government National Mortgage Association guaranteed, mortgage-backed, fully modified pass-through securities, assuming prepayment in 12 years on pools of 30-year FHA/VA mortgages carrying the prevailing ceiling rate. Monthly figures are unweighted averages of Monday quotations for the month. These securities should be approximately trading at par. If they are not trading at par, the arbitrary assumed maturity of 12 years clouds the interpretation of the reported yield figures.

**Yields adjusted to constant maturities by the U.S. Treasury. That is, yields are read from a yield curve at fixed maturities. Based on only recently issued, actively traded securities.

Source: Federal Reserve Bulletin, various issue.

Table 5.2

Prices of Various Fixed-rate Securities and Associated Call Options as a Function of Term to Maturity when the Coupon Rate of the Bonds is 8 Percent and the Current Interest Rate is 12 Percent per Year

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Years to Maturity	Percentage Yield-to-Maturity of a Discount Bond	Non-amortized Non-callable Bond	Non-amortized Callable Bond	Value of the Call Option for the Non-amortized Callable Bonds	Amortized Non-callable Bond	GNMA Security with the Optimal Call Policy	Value of the Call Option for the GNMA Security
0	12.0000	100.000	100.000	0.000	100.000	100.000	0.000
5	9.3597	94.139	93.036	1.103	95.511	95.053	.458
10	8.7208	93.891	91.887	2.004	94.568	93.418	1.150
20	8.3617	93.880	91.474	2.406	94.089	92.165	1.924
30	8.2411	93.880	91.432	2.448	93.959	91.724	2.235

VI. IMPLEMENTATION PROBLEMS

Introduction

If 10-year, callable mortgages are to be introduced, either the CMHC can undertake the initial role or it can persuade financial institutions to provide such mortgages. There are many different types of problems which must be addressed, before the actual introduction of such a program. The purpose of this chapter is to identify some of these problems and to examine possible solutions to some of these problems.

Design Features

1. What type of product is to be sold? Does the product provide the mortgage borrower with mortgage interest rate insurance (MRI) or mortgage payment insurance (MPI)? Because of possible difficulties in explaining to the mortgage borrower what is and is not covered under mortgage interest insurance, mortgage payment insurance has the advantage of simplicity. While MPI provides greater protection to the mortgage borrower than MRI, it implies that greater risk is borne by the insurer.

2. In providing 10-year, callable mortgages, should the call feature be designed to provide mortgage renewal at the initial rate, or to provide for renewal only in the event of a catastrophic increase in mortgage rates? The cost of being able to renew the mortgage in the event of a catastrophic increase in mortgage rates will be less than the cost of being able to renew the mortgage at the initial rate.

3. In the event of a person selling a house, which is financed with a 10-year, callable mortgage, can the mortgage be transferred to the new house, or can the mortgage be taken over by the new owner of the original house? There appears to be no reason why the 10-year, callable mortgage should not be assumable by the new owner, as is the case with existing mortgage instruments.

4. If interest rates fall, a person with a callable mortgage may decide that it is cheaper to have a conventional mortgage and want to cancel the option to renew the mortgage. Closely related to this point is the question of prepayment privileges. Should such privileges be granted, and if so, should penalties be attached if the privileges are used?

The granting of prepayment privileges results in a shifting of the risk from the borrower to the lender. This issue and the ability of lenders to offset such risk has been addressed in Chapter Five. Further discussion will be given later in this chapter - see section (1(e)).

Start-up Problems

The demand for 10-year, callable mortgages is unknown. The demand will depend upon the conditions for renewing the mortgage and the price of the call option. As discussed in Chapter Five, the price of the call option will depend upon the anticipated volume of demand, which is unknown.

One way to resolve some of this uncertainty is for a trial program to be undertaken. This immediately raises the question of

how to launch such a program. Three possibilities with direct CMHC participation are examined. Initiatives on the part of financial institutions are discussed later.

1. CMHC issues, say, a $25 million 10-year, retractable bond, at par, with CMHC having the option to call the bond at year 5. By comparing the bond with a straight 5-year Canada bond, the amortized value of the put option can be determined. The money is used to make direct 10-year, callable mortgage loans. The rate charged is the going rate on 5-year conventional mortgages plus the amortized value of the put option. It is announced that CMHC is launching a trial program lasting six months and up to $25 million in mortgages will be offered. What are the risks associated with such a program?*

   (a) There could be no demand for 10-year, callable mortgages. In this case CMHC, after six months, could invest the proceeds in Government bonds. Apart from having to possibly pay a semi-annual interest payment**, it faces the risk that over the six month period interest rates may fall. Thus the interest income from such an investment would be less than the interest payments on the retractable bond.

   (b) Mortgage rates drop once the bond is issued. Consider a worst case scenario. Suppose that CMHC issues a 10-year, retractable bond with a coupon of 17% and it determines that the amortized value of the put option is 100 basis points.

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*The following is not meant to be a definite list.

**CMHC could reduce this risk by investing unused proceeds in some form of interest-bearing money account.

CMHC offers 10-year, callable mortgages at the going 5-year conventional mortgage plus 100 basis points. The 5-year mortgage rate at the time of the issue is 19%. However, immediately after the bond is issued, suppose that the 5-year mortgage rate drop to 14% and stays at this rate for the six months the program is open.* This implies that mortgage borrowers can take out 10-year, callable mortgages at a rate of 15%.

Over the first 5-year period, CMHC must make interest payments of .17 M_o on its retractable bonds, where M_o is the face value of the bond. It receives mortgage payments (interest plus principal) of .1547 M_o**, implying a deficit of .0153 M_o each year.

In 5 years time, if mortgage rates have increased to 22% (their approximate high in 1981), then it will be the interests of the mortgage borrower to utilize their option to renew their mortgages at the 15% rate. In this case CMHC will continue to lose .0153 M_o each year***. As explained in Appendices A and C, CMHC will face a further deficit in year 10, as the face value of its maturing retractable bond will be greater than the amortized values of the mortgages. Such a problem will occur in year 5, if mortgage rates are below the renewal rate of 15%.

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*These figures roughly describe the situation in June 1982. By December 1982, 5-year mortgages were in the region of 14% (Bank of Canada Review, March 1983).

**It is assumed that CMHC makes mortgage loans up to a total of M_o. The mortgage rate is 15% and mortgages are amortized over a 25 year period.

***It is always possible that this deficit may be reduced, if interests change in such a way to make it advantageous for CMHC to retract its bond and issue a new 5-year bond.

(c) The demand for the 10-year, callable mortgage is going to occur randomly over the six month interval. This implies that different mortgage borrowers are going to have, in general, different effective mortgage renewal rates, as the mortgage rate changes. Hence this is similar to the case discussed in section (1(b)). A second implication is that in 5 years time, CMHC will have to make a decision to retract its bond before mortgage borrowers decide on whether to renew their mortgages.

Consider a worst case situation. All of the demand for 10-year, callable mortgages occurs 6 months after the CMHC bond issue. In 5 years time the CMHC must decide on whether to retract its bond. If the 5-year bond rate is above 17%, CMHC decides not to retract the bond. Suppose that over the next six months bond and mortgage rates collapse, so that mortgage borrowers decide to use their call option and to renegotiate a new mortgage. The risk facing the CMHC is that the amortized value of the mortgages may be less than the value of its retractable bond. The CMHC also faces reinvestment risk over the 5 year period*. If mortgage rates do not collapse, so that mortgage borrowers renew their mortgages then the situation facing the CMHC does not change**. It still faces the consequences of amortization and reinvestment risk in year 10.

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*Amortization and reinvestment risk is discussed in Appendices A and C.

**As shown in section (1(b)), it is possible for CMHC to be incurring a yearly deficit.

If the 5-year bond rate is below 17%, CMHC may decide to exercise its option to retract the maturity of its bond. As the mortgage borrowers make their decisions six months later, CMHC must decide whether to borrow for six months, if it anticipates mortgage borrowers utilizing their option to call their mortgages, or to issue a 5-year bond with a lower coupon, if it expects mortgage borrowers to renew their mortgages. If CMHC borrows for six months and during that period mortgage rates rise, so that mortgage borrowers renew their mortgages, then CMHC could issue a 5-year bond. If CMHC, anticipating mortgage borrowers to renew their mortgages, had issued a 5-year bond and over the six month period mortgage rates fall to the extent that mortgage borrowers decide not to renew their mortgages, then this exposes CMHC to the consequences arising from amortization risk and to the change in interest rates over the six month period.

(d) Over the six month period the premium for the mortgage renewal is fixed. In Chapter Five it was argued that changes in interest rates and in the uncertainty about future interest rates, would cause the premium to change. The financial consequences to CMHC of such changes are similar to those arising from changes in the mortgage rate, discussed in section (1(b)), and so further discussion is not required.

The fixing of mortgage renewal premiums raises two policy questions. Firstly, the fixing of the premium for extended periods of time implies that implicit subsidiaries

are being provided by CMHC to mortgage borrowers. Secondly, if CMHC wants to encourage financial institutions to provide 10-year, callable mortgages, then the mortgage renewal premium must be priced at a competitive and not a subsidized rate. Further discussion of this issue is given in section (2(c)).

(e) If prepayment privileges are granted to mortgage borrowers, then this exposes CMHC to reinvestment risk. However, as noted in Chapter Four, prepayments often occur even when interest rates are increasing which, ceteris paribus, reduces reinvestment risk. It should be noted that the granting of prepayment privileges implies the existence of a call option. CMHC can partially offset the risk arising from prepayment privileges by issuing its 10-year retractable bond with a sinking fund feature.

If a mortgage borrower wants to cancel the option to renew the mortgage, then this increases the amortization risk to CMHC. For example, if the mortgage rate on the 10-year, callable mortgage was 15%, and the amortized value of the put option was 100 basis points, then if the mortgage borrower could cancel the option to renew the mortgage, the mortgage rate would become 14%. This would reduce the level of mortgage payments received by CMHC. As a sinking fund feature does not offer protection against cancellation, the only way for CMHC to avoid this risk is not to allow cancellation.

2. The second way to launch the program is for CMHC to estimate* the premium to charge for mortgage renewal. This premium is added to the 5-year mortgage rate. For a six month period CMHC sells 10-year, callable mortgages up to a total of $25 million. At the end of the period CMHC then issues a 10-year, retractable bond**.

What are the risks associated with such a program?

(a) If there is no demand for 10-year, callable mortgages, then the CMHC does not issue the retractable bond. By waiting until the end of the period, problems arising from uncertain demand tend to be minimized. However, it is possible for the demand to be quite small, too small to warrant the costs associated with a bond issue. While the CMHC is exposed to risk, the dollar magnitude will be small.

(b) Mortgage rates fluctuate over the six month period. If mortgages are initially 'low' and increase over the six month period, then the people who took out a 10-year, callable mortgage at the beginning of the period will be paying lower monthly mortgage payments than those who took out a mortgage at the end of the period. The worst case scenario is for mortgage rates to increase over the period, and for the major demand for the 10-year, callable mortgages to occur when mortgage rates are low. Suppose that CMHC estimates the amortized value of the put option to be 100 basis points and offers 10-year, callable mortgages at

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* This could be estimated along the lines outlined in J.E. Pesando and S.M. Turnbull, "The Pricing and Reception of Bonds Extendible at the Option of the Government of Canada", May 1983.

** Some form of short-run financing is required to finance the mortgage loans before the CMHC issues its 10-year retractable bond.

100 basis points above the 5-year mortgage rate. At the start of the period, suppose the 10-year, callable mortgage rate is 16% and at the end of the period, 22%*. Suppose that all of the demand for 10-year, callable mortgages occurs at the beginning of the period and that CMHC waits until the end of the period before it issues a $25 million, 10-year, retractable bond.** The yield on the bond is 19%.*** Each year CMHC must pay .19 M_o in interest charges, where M_o is the face value of the bond. It receives mortgage payments of .164 M_o,**** implying a deficit of .026 M_o.

CMHC faces another type of risk in year 5. Mortgage borrowers must decide whether to use their call option and renegotiate a new mortgage before CMHC must decide on whether it should retract the maturity of its bond. If mortgage rates remain above 16%, then the mortgage borrowers will stick to their original mortgages and not exercise their call option. If the 5-year bond rate falls below 19%, then it will be in CHMC's interests to call its bond and to issue a 5-year bond. This will reduce its yearly deficit. However, CMHC will still face the consequences of amortization risk in year 10.

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* This roughly describes what occurred during the first part of 1981.

** These assumptions are made to explore the consequences of a worst case situation. In practice, the demand will be distributed over time.

*** In September 1981, the interest rate on 3-5 year Canadas was 18.68% and on 5-10 year Canadas 17.94%.

**** It is assumed that the mortgages are amortized over a 25 year period.

If mortgage rates are below 16%, then mortgage borrowers will exercise their call options and renegotiate new mortgages. CMHC will exercise its call option. It must pay M_o, though it receives only .972 M_o from the mortgage borrowers*.

(c) The mortgage renewal premium is estimated and fixed over the period. As discussed in section (1(d)) there are financial and policy implications for fixing the premium. As argued in Pesando and Turnbull**, market participants should be able to estimate "reasonably well" the required premium. This being the case, then as the economy changes, new estimates can be used for the mortgage renewal premium. Once the program is under way and the market is familiar to pricing 10-year, retractable bonds, it is reasonable to expect, on average, a reduction in the uncertainty associated with such estimates. Given that conventional mortgage rates are changed on a frequent basis, there is no reason why mortgage renewal premiums cannot be changed with the same frequency.

3. The third way to launch the program is similar to the second way, except that CMHC issues mortgage-backed securities (MBS's) instead of a 10-year, retractable bond at the end of the period. MBS's, although new to Canada, have been in existence for over a decade in the U.S. The usual form of MBS in the U.S. is characterized by the Ginnie Mae. As explained in Chapter Four, a Ginnie Mae is

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*This is the book value of the mortgage at the end of year 5.

**"The Pricing and Reception of Bond Extendible at the Option of the Government of Canada", May 1983.

a security with a maturity of thirty years. The payments from a homogeneous collection of (default insured) mortgages are past through to the holders of the security. The GNMA provides a guarantee of timely payments to the holders. The mortgage borrowers in the mortgage pool have complete prepayment privileges, without any form of penalty.

In introducing such instruments to Canada, a number of design decisions must be addressed.

(a) Should a pool of mortgages have a homogeneous coupon? If a mortgage pool has a homogeneous coupon, then this simplifies the analysis of the trading properties of a MBS. However, the originator faces risk in trying to construct a pool of mortgages with a homogeneous coupon, when mortgage rates can change. One way to reduce such risk is for financial institutions to issue MBS's for 30-day forward delivery, and to commence origination of mortgages with a forward delivery of funds. Alternatively, a MBS could be issued with a mortgage pool of heterogeneous coupons. While this reduces the risk to the originator, it does pose a problem to the potential investor trying to determine the pricing characteristics of such an instrument. To reduce such difficulties, the mix of possible coupons could be limited. For example, half of the mortgages could have one coupon rate and the remainder another coupon rate.

(b) The minimum mortgage pool at the time of issue of a Ginnie Mae is $500,000 (U.S.). The average size is currently $2.1 million (U.S.). In determining the size of an issue there are a number of different factors to consider. In the origination process, the smaller the size of the issue, the lower is the risk of a change in the mortgage rate, other things equal. To encourage an active and liquid secondary market, it is necessary to have a sufficient number of shares of financial instruments to trade and a sufficient number of investors in the market. If the issue size is small then, ceteris paribus, it is necessary to have a frequent number of issues. While the issuance of a 'large' Ginnie Mae with many subscribers may enhance the liquidity of the market, it has been found that an active liquid secondary market has developed given a policy of a frequent number of small issues.

(c) For Ginnie Maes, the maximum size of any one mortgage in a mortgage pool is $50,000.* Given that the minimum size of a mortgage pool is $500,000, then there must be at least ten mortgages in a mortgage pool. The restriction of a minimum number of mortgages within a pool, is an attempt to ensure that the characteristics of the MBS are not dominated by one particular mortgage in the mortgage pool. For Canada presumably the maximum size of any one mortgage

*For MBS's with private insurance mortgages, mortgages in excess of $50,000 are possible.

would be greater than $50,000. If the maximum size of a mortgage to be included in a pool is set at, say, $150,000, then to ensure that there are at least 10 mortgages within the pool, the minimum issue size would be $1.5 million.

(d) For Ginnie Maes there are two forms of guarantees. The mortgages are insured against default and the GNMA provide a guarantee of timely payment. Consequently, to the Ginnie Mae investor there is no form of default risk. The elimination of default risk saves the investor the costs of investigating the credit worthiness of the underlying mortgages. The guarantee of timely payments has been a major factor contributing to the liquidity of the secondary market in Ginnie Maes. Hence, if an active secondary market of MBS's is to be developed in Canada, it is necessary for CMHC to provide a guarantee of timely payments.

In the U.S. the GNMA only considers mortgages with default insurance provided by the FHA and/or the Veterans Administration (VA). The fee charged for this service depends upon the risk of the mortgage loan. In providing a guarantee of timely payments, the GNMA charges a fee of .005% per month (.06% per year) of the remaining principal balances of the loans in the pool. For the CMHC to provide a guarantee of timely payment, it is necessary for it to determine a price for providing such a service. If the CMHC wants to encourage private insurance companies to provide default insurance, then it is necessary for it to price default

insurance at a competitive rate, free from any form of subsidization. In the pricing of the timely payment insurance, it may wish to study the experience of the GNMA in providing such a service.

(e) For a pass-through security the originator is responsible for the collection of mortgage payments and ensuring that investors receive on time the appropriate payments. In the U.S. the GNMA allows a fee of .0367% per month (.44% per year) of the remaining principal balances of the loans in the pool. In determining an appropriate fee structure for Canada, the CMHC may again wish to study the U.S. experience.

(f) In the U.S. Ginnie Maes are considered obligations of the Government and as such, filing requirements with each new issue are minimal. Presumably a similar situation would occur in Canada.

What are the risks associated with such a program?

(g) Given that the consequences of some of the risks arising from random demand are discussed in section (2(a)), no further discussion is required.

(h) Mortgage rates can fluctuate over the six month period. The risk facing the CMHC as originator is that it makes a mortgage loan at one rate and possibly issues a MBS at another rate. For the MBS originator, forward delivery and reducing the issue size, subject to a minimum size constraint, are means of reducing this risk. The issuance

of a MBS with a mixed coupon mortgage pool and use of forward delivery is another means of reducing this risk. The magnitude of this risk depends, in part, upon the demand for mortgage loans

Advantages and Disadvantages of the Three Programs

The major disadvantage of program one is that CMHC issues a liability before it knows the demand for 10-year, callable mortgages. Programs one and two have the disadvantage of exposing CMHC to instrument and amortization risk. With program three CMHC avoids instrument and amortization risk. However, the program has the disadvantage that CMHC must incur the costs of setting up the institutional machinery to service MBS's. In addition, the CMHC must determine how to price the guarantees associated with default and timely payment insurance. It also incurs risk in the initial origination process. The advantages of the program are that it provides 10-year, callable mortgages and it introduces MBS's to Canada.

The Role of Financial Institutions

What additional risks would financial institutions incur if they started to introduce 10-year, callable mortgages? For the past few years financial institutions having been attempting to deal with the consequences of a maturity mismatching of assets and liabilities, caused by lending long, borrowing short. The introduction of a 10-year, callable mortgage would not ameliorate such a problem. As this subject has been discussed in Chapter Five, attention will be focussed on possible ways for

financial institutions to share, if they desire, the risks associated with issuing 10-year, callable mortgages.

(a) Financial institutions issue 10-year, callable guaranteed investment certificates (GIC's) with the borrower having the option to call. This is similar to the case of CMHC issuing a 10-year, retractable bond. Thus there is instrument and amortization risk.

(b) Financial institutions can offset instrument and amortization risk by issuing mortgage-backed securities (MBS's). Such instruments are new to Canada and, as such, there are start-up costs. If the Gimmie Mae model is followed, then it is necessary for the CMHC to provide, at a price, a guarantee of timely payment.

At least initially, the CMHC may be the sole originator of the mortgages which comprise the mortgage-backed securities, as private lending institutions might prefer to wait and observe the market reaction to this initiative.

The Recent U.S. Experience in Risk Sharing Initiatives

MBS's have been trading in the U.S. for over a decade. Recently, there have been moves to innovate in the design of MBS's, by altering the risk sharing characteristics, to make them attractive to a wider range of investors. Suggested innovations have been along the following lines:

1. semi-annual instead of monthly payments;
2. various types of prepayment privileges. Already MBS's are classified as to whether their prepayment rates are 'fast'

or 'slow'. This suggestion would legally formalize the prepayment characteristics. For example, some MBS's may allow prepayment only after a certain period;

3. to have different maturities. Currently, Ginnie Maes have a maturity of 30 years, though their average maturity is 12 years, because of prepayment and callability;

4. for a given pool of mortgages, to issue different types of MBS's. For example, the initiator may reinvest any prepayments, so that a particular type of MBS would have a predetermined payment schedule over a specified period.

Given the potential benefits of MBS's, the CMHC in the initial trial program may want to provide a lead to private lending institutions by acting as an initiator and issuing MBS's. In doing so, it should attempt to provide an environment to encourage financial innovation and the development of an active secondary market.

Conclusions

Given the uncertainty about the demand for 10-year, callable mortgages, it is suggested that the CMHC undertake a trial program to resolve some of the uncertainties. Three possible CMHC initiatives have been described. However, it is recommended that the first initiative of the CMHC issuing a 10-year, retractable bond before making mortgage loans, should not be undertaken. If there is sufficient demand, it is suggested that to encourage private lending institutions to issue 10-year, callable mortgages, the CMHC acts as an initiator and issues mortgage-backed securities. It is recommended that, at least initially, cancellation of the option to renew the mortgage not be allowed.

Appendix A

THE MECHANICS OF THE PESANDO-TURNBULL PROPOSAL FOR MORTGAGE RATE INSURANCE

The purpose of this Appendix is to illustrate the practical mechanics behind the Pesando-Turnbull (P-T) proposal and to identify what assumptions are required in order to remove all underwriting risk.* It is assumed that the CMHC is prepared to offer insurance for a fixed period of, say, five years. It issues, at par, a 5-year bond with CMHC having the option to extend the maturity of the bond for another 5 years at year 5. It is assumed that the required yield on this bond is 11%, with the yield on a 5-year Government of Canada bond being 10%, implying that the amortized cost of the insurance is 100 basis points. The 5-year mortgage rate is 12%, and the cost to the borrower of a 5-year mortgage together with mortgage rate insurance is thus 13%.

With the proceeds of the retractable issue, CMHC invests in the 5 year Government of Canada bond. Over the 5-year period the interest charges associated with the extendible bond are paid for by the interest received from the investment in the 5-year bond plus the insurance premiums. To cover underwriting, investment, and administration costs, the premium charged for insurance will, in general, be above 100 basis points. Hence over the initial 5-year period all costs are covered.

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*To focus on the consequences of instrument and amortization risk, default risk is neglected.

Pricing of the Insurance

If the interest rate on a straight 5-year Government of Canada bond is 10%, then the market value of the extendible bond MV_E, is

$$MV_E = \sum_{t=1}^{5} \frac{.10\, M_o}{(1+.10)^t} + \frac{M_o}{(1+.10)^t} - \text{MV of Put Option},$$

where M_o is the face value of the bond. Hence, by comparing the market value of the straight bond with the extendible bond, the value of the put option, MV_p, can be determined.

If the straight bond sells at par, then the extendible, if it has the same coupon, will sell at a discount, the dollar difference being MV_p. In order for the CMHC to pay the interest charges on the extendible, it is necessary for it to use the proceeds of the issue MV_E plus the value of the option, MV_p, and invest in the straight 5-year bond. This suggests the following pricing policies:

1. it could charge the insurance purchaser the full amount, MV_p, to be paid immediately.

2. CMHC could borrow the amount, MV_p and charge the insurance purchaser an annual amount, L, over the 5 year period, where* $MV_p = \sum_{t=1}^{5} L/(1+.10)^t$.

In practice, bonds are usually issued at par, implying that, for the extendible, the value of the option is amortized in the coupon. If the extendible is issued at par with a coupon of 11%, the amortized value of the insurance is 100 basis points. If, in 5 years time, interest rates have increased and the insurance is utilized, the home owner will

*While this type of payment schedule may be criticized, it has the merit of simplicity.

continue to make the insurance payments, implying the existence of an effective deductible; it will only be in the interests of the home owner to utilize the insurance if interest rates go above 10% plus the amortized cost of the insurance. If the insurance is not utilized, insurance payments terminate. For example, if in 5 years time the 5 year interest rate is 10¼%, then the home owner could utilize the interest rate insurance receiving annual payments of $(.105 - .10)M_o$ for the next 5 years. However, the home owner must continue to make annual insurance payments of $(.1)M_o$. It will only be in the interests of the home owner to utilize the interest rate insurance if interest rates go above 10+1 percent, implying an effective deductible of one percent.

Underwriting Risk

To examine the possible risks faced by the CHMC when the mortgage is renewed, three cases are considered. In the first case there is an increase in the spread between mortgage and bond rates. The second case considers an decrease in the spread and in the third case there is no change in the spread. Details are given in Table A1. The reasons behind the existence and changes in the spread raise an array of questions. In the absence of default, the spread reflects differences in liquidity, servicing costs and possible call features, as well as the net result of any segmentation in the credit markets.

Case 1 Spread Increases

Instrument Risk: Underwriting Loss

The spread increases from 200 to 400 basis points. The value of the home owner of being able to renew the mortgage at 12% is*

$$\text{Value of the claim, } VC \equiv \sum_{t=1}^{5} \frac{(.15 - .13)M_o}{(1 + .15)^t} = .067\, M_o$$

where the amortization of principal is, for the moment, neglected. M_o is the initial face value of the mortgage. For simplicity and without loss of generality, it is assumed that payments are made on an annual basis. The value of the option to extend the bond, VE, is

$$VE = \sum_{t=1}^{5} \frac{(.11 - .11)M_o}{(1 + .11)^t} = 0,$$

the face value of the bond, by design, is M_o. The option to extend the maturity of the bond is worthless, when the 5 year rate is 11%. In this case, the increase in the spread results in CMHC suffering an underwriting loss. The increase in the spread causes the value of the claim to be greater than the value of the option to extend.

Direct Mortgage Lending

It is not possible for the CMHC to avoid this risk by direct mortgage lending. Suppose CMHC extends the maturity of its bond, which is trading at par. With the proceeds from the maturing 5 year bond, M_o, CMHC makes a direct mortgage loan at the going rate of 15%. The present value of this investment is, of course, M_o, in a competitive

*As the home owner must continue to pay for the insurance, the effective renewal rate is 13%.

market. Hence while CMHC is investing at 15% and paying 11% on its debt, the present value of its investment is M_o and the present value of its debt is M_o, implying that the net present value is zero. Thus CHMC is unable to avoid the underwriting loss.

Amortization Risk

While the above example demonstrates the risk of a change in the spread between mortgage and interest rates-instrument risk, there is another risk arising in mortgage payment insurance (MPI)-amortization risk. In MPI the total mortgage payments are insured. In this case the value of the claim for an equal payment mortgage is*

$$VC \equiv \sum_{t=1}^{5} \frac{L_{15} - L_{13}}{(1 + .15)^t} + \frac{M_{15}(10) - M_{13}(10)}{(1 + .15)^5}$$

when L_{R_M} denotes the mortgage payment (interest plus principal), when the mortgage rate is R_M; and $M_{R_M}(t)$ is the book value of the mortgage in period t, given a mortgage rate of R_M.

Again it is not possible for CMHC to avoid this risk by direct mortgage lending. The proceeds from the maturing 5 year bond equals the market value of CMHC debt, implying that the net present value of its position is zero.

Elimination of Instrument and Amortization Risk

To avoid instrument and amortization risk and thus eliminate all underwriting risk, it is necessary for the CMHC to be able to issue

*The insured mortgage rate, 13%, is one percent above the initial going rate. This difference reflects the cost of the insurance. The mortgage is amortized at the insured rate of 13%.

an extendible bond with the payment characteristics of a mortgage (principal is amortized) and for thus bond to be priced as a mortgage instrument. As before CMHC issues a 5 year bond, extendible at the borrower's option, for 5 years. The bond has the payment characteristics of a mortgage. The initial market value of the bond is

$$\sum_{t=1}^{5} \frac{L_{12}}{(1 + .12)^t} + \frac{M_{12}(5)}{(1 + .12)^5} - \text{MV of Put Option},$$

where it is assumed that even though CMHC is issuing such an instrument, the market prices the mortgage payments as a conventional mortgage.* This is an important assumption and an assumption that is moot. The spread between mortgage and bond rates reflects differences in liquidity, servicing costs, and possible market segmentation in the credit markets. As the Government is issuing such an instrument, it is questionable whether such an instrument would carry the same liquidity, servicing cost, and market segmentation premiums as a conventional mortgage.

Applying the same type of argument developed in the original Pesando-Turnbull proposal, the value of the put option can be determined by comparing the value of the extendible with a 5 year conventional mortgage. The value of the put option will reflect the instrument and amortization risk associated with mortgage payment insurance. For CMHC to offset the annual interest plus principal, which total L_{13}, it can invest the proceeds from its debt issue into a 5 year conventional mortgage, which pays L_{12} per year. The difference is eliminated by the insurance payment it receives each year.

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*The extendible bond is priced to sell at par. It is assumed that the insured mortgage rate is 13% and the mortgage payments are determined at this rate. This implies that the annual insurance cost is $L_{13} - L_{12}$.

At year five, it is in CMHC's interest to extend the maturity of its debt. The market value of the instrument is

$$\sum_{t=1}^{5} \frac{L_{13}}{(1 + .15)^t} + \frac{M_{13}(10)}{(1 + .15)^5} ,$$

implying that CMHC is now able to reap the benefits of the increase in the spread. CMHC can invest the proceeds from its investment in the maturing 5 year mortgage in a new 5 year mortgage. Hence the present value of its net investment is

$$\sum_{t=1}^{5} \frac{L_{15}}{(1 + .15)^t} + \frac{M_{15}(10)}{(1 + .15)^5} - \sum_{t=1}^{5} \frac{L_{13}}{(1 + .15)^t} + \frac{M_{13}(10)}{(1 + .15)^t}$$

which is exactly equal to the present value of the insurance claim.

Case 2 Spread Decreases

The spread decreases from 200 to 100 basis points. For the case of no amortization of principal, the market value of the insurance to the home owner is

$$VC = \sum_{t=1}^{5} \frac{(.14 - .13)M_o}{(1 + .14)^t} = .034\ M_o$$

The market value of CMHC's debt is

$$\sum_{t=1}^{5} \frac{.11\ M_o}{(1 + .13)^t} + \frac{M_o}{(1 + .13)^5} = .929\ M_o$$

The proceeds, M_o, from the maturing 5-year bond can be reinvested. In a competitive market, the present value of the reinvestment equals

M_o. Hence, the net present of CMHC's portfolio is

$$M_o - .929\, M_o = .071\, M_o \ ,$$

which is greater than VC; the magnitude of the decrease in the value of the extendible bond, a liability to CMHC, is greater than the value of the insurance claim*. In this case, it is seen that CMHC makes an underwriting gain, though the magnitude of the gain depends upon the level of interest rates.

For mortgage payment insurance, the value to the home owner of being able to renew the mortgage at 13% is

$$VC = \sum_{t=1}^{5} \frac{L_{14} - L_{13}}{(1 + .14)^t} + \frac{M_{14}(10) - M_{13}(10)}{(1 + .14)^5} = .0322\, M_o \ ,$$

where M_o is the initial mortgage value**. Again, it is seen that an underwriting gain occurs***.

Case 3 Constant Spread

The spread remains constant at 200 basis points. For the Case of no amortization of principal, the market value of the insurance to the home owner is

$$VC = \sum_{t=1}^{5} \frac{(.15 - .13)M_o}{(1 + .15)^t} = .067\, M_o$$

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*The percentage change in the value of a perpetuity is inversely related to the level of interest rates. The change in the dollar value of the extendible bond, as interest rates move from 11 to 13%, is greater than the change in the dollar value if interest rates move from 13 to 14%.

**The initial amortization period of the mortgage is assumed to be 25 years.

***In providing such insurance, the question of whether CMHC should issue an extendible bond with a face value of M_o or $M_{13}(5)$, or possibly some other value, is not explored.

The market value of CMHC's debt is

$$\sum_{t=1}^{5} \frac{.11\ M_o}{(1 + .13)^t} + \frac{M_o}{(1 + .13)^5} = .930\ M_o$$

The proceeds, M_o, from the maturing 5-year bond can be reinvested. In a competitive market, the present value of the reinvestment equals M_o. Hence, the net present value of CMHC's portfolio is

$$M_o - .930\ M = .070\ M_o$$

which is greater than VC. Again the CMHC makes an underwriting gain.

For mortgage payment insurance, the value to the home owner of being able to renew the mortgage at 13% is

$$\text{Value of the claim, } VC \equiv \sum_{t=1}^{5} \frac{L_{15} - L_{13}}{(1 + .15)^t} + \frac{M_{15}(10) - M_{13}(10)}{(1 + .15)^5}$$

$$= .0628\ M_o$$

where M_o is the initial value of the mortgage. The CMHC makes an underwriting gain.

Summary

In its original form the Pesando-Turnbull proposal exposes CMHC to instrument and amortization risk. By issuing an instrument with the payment characteristics of a conventional mortgage and assuming that such an instrument is priced as a conventional mortgage, then it is possible for CMHC to issue mortgage payment insurance without instrument or amortization risk.

Table A1

Description of the Three Scenarios

	Instrument	Today	5-Years Later
Case 1	Spread Increases		
	5-year Canada Rate	10	11
	5+5 Extendible Bond	11	
	Mortgage Rate	12	15
	Mortgage with Insured Renewal Rate (No Deductible)	13	
Case 2	Spread Decreases		
	5-year Canada Rate	10	13
	5+5 Extendible Bond	11	
	Mortgage Rate	12	14
	Mortgage with Insured Renewal Rate (No Deductible)	13	
Case 3	Spread Constant		
	5-year Canada Rate	10	13
	5+5 Extendible Bond	11	
	Mortgage Rate	12	15
	Mortgage with Insured Renewal Rate (No Deductible)	13	

Appendix B

INSTRUMENT RISK IN THE MORTGAGE INSURANCE RATE PROPOSAL

In principle, all sources of risk to the CMHC in the mortgage rate insurance proposal can be eliminated except for instrument risk. As noted in Appendix A, the major source of underwriters risk lies in the potential for large losses (gains) if the spread between mortgage and bond rates is substantially higher (lower) at the date of the mortgage renewal compared to the date at which the mortgage is taken out. Data presented in Table B1 provide evidence on the quantitative importance of this problem. For the period 1960:1 - 1983:3, based on monthly data, the spread between the 5-year conventional mortgage rate and the yield on 3-5 year Government of Canada bonds averaged 268 basis points.* There is, however, substantial dispersion around this mean. The spread ranged from 34 to 549 basis points and had a standard deviation of 88 basis points. For the subperiod 1972:1 to 1983:3, dispersion around the mean spread was greater than in the 1960:1 - 1971:12 subperiod, and the mean spread itself was slightly greater.

*To provide a further perspective, the spread between the conventional mortgage rate and the 5-10 year Government of Canada rate is also presented here and in subsequent tables.

An additional perspective on the quantitative importance of instrument risk is provided by the data presented in Table B2. This table shows the change in the mortgage-bond rate spread at each point in time from the spread prevailing 5 years earlier. As noted in Appendix A, this divergence is crucial to the determination of the underwriting risks faced by the CMHC. For the full sample period 1966:1 - 1983:3, the mean change in the spread is very close to zero. Again, however, there is substantial dispersion around this mean. The change in the spread ranged from -472 basis points to 314 basis points, with a standard deviation of 126 basis points. The lesson must be that there is substantial instrument risk. Data for the two subperiods suggest that this instrument risk has increased somewhat in recent years.*

If the CMHC were to underwrite mortgage rate insurance in the proposed fashion, it would be expected that the CMHC would experience potentially large underwriting gains and losses. This fact invites two additional questions: (1) would these gains and losses be likely to net out over time, and (2) if so, how rapidly could they be expected to "wash"?

Note, in the context of (1), that the "catastrophic" scenario for the CMHC would be one in which the spread between the mortgage and bond rates increased sharply and secularly over time. In this case, underwriting losses would persist indefinitely. The data indicate, by contrast, that the mean spread has increased only moderately over time (Table B1). As discussed later, an analysis of the potential

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*Because the 3-5 year Government of Canada rate is not strictly comparable to the 5-year conventional mortgage rate, one might conjecture that the volatility of the mortgage-bond rate spread would be reduced if the spread were calculated using the rate on 5-year Government of Canada bonds. In fact, spot comparisons of the 5-year mortgage rate with the rate on a 5-year Canada bond trading at par suggested that this effect is not likely to be very important.

sources of movements in the mortgage-bond rate spread provides no basis for presuming that this spread would be likely to rise secularly over time. The suggestion is that the underwriting risks borne by the CHMC would be diversifiable in an intertemporal sense.

In the context of (2), the crucial issue is the serial correlation in movements in the mortgage-bond rate spread over time. If there is no serial correlation in these movements, so that they are "white noise", then gains and losses should net to zero "relatively" quickly. By contrast, if these movements tend to have pronounced (positive) serial correlation, movements in one direction tend to be followed by movements in the same direction. As a result, underwriting gains and losses will tend to persist. To provide some empirical evidence on this issue, we ran some diagnostic regressions designed to highlight the serial correlation properties of the mortgage-bond rate spread. The results are presented in Table B3, under the section called "Second Order Autoregressions". In both the 1960:3 to 1971:12 and 1972:1 - 1983:3 subperiods, the spread between the mortgage rate and the rate on 3-5 year Canada bonds exhibited significant positive serial correlation.* The implication is that movements in the mortgage-bond rate spread are likely to exhibit persistence, and hence that the underwriting gains and losses experienced by the CMHC are not likely to "wash" quickly.

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*For both subperiods, these results suggest that - if only first order serial correlation were explored - the first order serial correlation coefficients would be in the neighborhood of 0.75.

To sum up, there are three key results:

(1) instrument risk is not trivial, and the CMHC would thus bear substantial underwriting risk;

(2) the mortgage-bond rate spread has not risen sharply and secularly over time, nor is there any reason to expect it to do so; and

(3) although (2) suggests that underwriting gains and losses are likely to net out over long periods of time, the pronounced serial correlation in the movements in the mortgage-bond rate spread suggest that these gains and losses are not likely to wash quickly.

There remains the question of why the mortgage-bond rate spread has varied over time, and this issue must also be addressed. In general, the rate on 5-year conventional mortgages differs from the 3-5 year Canada rate because the instruments differ. The mortgage has a pre-payment or call option whose value at the date of issue is typically nonzero. The mortgage has (or may have) default risk as well as servicing costs. The mortgage, unlike Canada bonds, has no well developed secondary market and thus will be priced to offer a higher yield than an otherwise identical Government bond. In addition, there may be divergent movements in the mortgage-bond rate spread due to the fact that capital markets are somewhat segmented, with some lenders being active in either the market for mortgages or Government of Canada bonds, but not both. Although investors who are active in both markets may arbitrage away

differences in the mortgage-bond rate spread that are not attributable to differences in the characteristics of the two instruments per se, many observers of financial markets believe that market segmentation represents a potentially independent source of divergent movements in the mortgage and bond rates.

In order to reduce the problem of instrument risk, one could - in principle - try to reduce the importance of the differences in the characteristics of the bond and mortgage instruments. Of particular note in this regard are changes in the value of the call option associated with mortgage prepayment privileges. If changes in the value of this option have contributed importantly to historical movements in the mortgage-bond rate spread*, then the elimination of prepayment options (or the setting of prepayment penalities so high that the option is assigned near zero value) will reduce the volatility of this spread in the future. Absent default risk (through mortgage insurance), changes in the mortgage-bond rate spread would reflect (1) changes in servicing costs, (2) changes in the value assigned by the market to the liquidity of Canada bonds, and (3) the net impact of forces related to market segmentation. Unfortunately, although one can presume that the volatility of the mortgage-bond rate spread will be reduced if only mortgages insured against default and without prepayment privileges are eligible for mortgage rate insurance, one cannot presume that the resulting volatility will be "small". Note, however, that there is nothing in the preceding analysis which suggests that the mortgage-bond rate spread is likely to rise over time, a result which has been cited earlier in this Appendix.

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*In the first part of Table B3, the reported regressions indicate that the mortgage-bond rate spread tends to rise with the level of the mortgage rate. If agents have in mind some "normal" mortgage rate, then the higher is the current mortgage rate, the greater will be the likelihood that rates will subsequently fall. In turn, this will imply that the value of the call option will be high, and hence that the mortgage-bond rate spread will rise.

Table B1

The Spread Between the 5-Year Conventional Mortgage Rate and the Yields on 3-5 Year and 5-10 Year Government of Canada Bonds, Monthly, 1960:1 - 1983:3

	Mortgage Rate less 3-5 Year Canada Rate (basis points)	Mortgage Rate less 5-10 Year Canada Rate (basis points)
1960:1 - 1983:3		
mean	268	244
std. deviation	88	74
range	34 to 549	50 to 508
1960:1 - 1971:12		
mean	257	230
std. deviation	63	48
range	145 to 474	144 to 390
1972:1 - 1983:3		
mean	279	261
std. deviation	107	92
range	34 to 549	50 to 508

Source: Bank of Canada

Table B2

Conventional Mortgage - Canada Bond Yield Spread,
Current less Five Years Earlier, Monthly, 1966:1 - 1983:3

	Mortgage Rate less 3-5 Year Canada Rate (basis points)	Mortgage Rate less 5-10 Year Canada Rate (basis points)
1966:1 - 1983:3		
mean	4	9
std. deviation	126	106
range	-472 to 314	-430 to 304
1966:1 - 1971:12		
mean	39	30
std. deviation	92	72
range	-104 to 257	-80 to 193
1972:1 - 1983:3		
mean	-15	-2
std. deviation	138	119
range	-472 to 314	-430 to 304

Table B3

Diagnostic Regressions with Mortgage-Bond Spread as Dependent Variable

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1. Mortgage Rate as Independent Variable

$$MORT_t - BONDS_t = \underset{(10.95)}{1.8333} + \underset{(5.28)}{0.0829}\ MORT_t$$

$R^2 = .090$ SEE = 0.838 D.W. = 0.41
SIMPL: 1960:1 - 1983:3

$$MORT_t - BONDS_t = \underset{(4.34)}{1.6111} + \underset{(3.28)}{0.0951}\ MORT_t$$

$R^2 = .075$ SEE = 1.036 D.W. = 0.48
SIMPL: 1972:1 - 1983:3

$$MORT_t - BONDL_t = \underset{(10.56)}{1.4111} + \underset{(8.14)}{0.1019}\ MORT_t$$

$R^2 = .193$ SEE = 0.668 D.W. = .052
SIMPL: 1960:1 - 1983:3

$$MORT_t - BONDL_t = \underset{(3.49)}{1.0517} + \underset{(5.31)}{0.1250}\ MORT_t$$

$R^2 = .175$ SEE = 0.843 D.W. = 0.58
SIMPL: 1972:1 - 1983:3

Table B3 continued

2. Second Order Autoregressions

$$MORT_t - BONDS_t = \underset{(3.00)}{0.293} + \underset{(13.74)}{1.133}\,(MORT_{t-1} - BONDS_{t-1}) - \underset{(2.88)}{0.243}\,(MORT_{t-2} - BONDS_{t-2})$$

$R^2 = .823$ SEE = 0.262 D.W. = 2.00
SIMPL: 1960:3 - 1971:12

$$MORT_t - BONDS_t = \underset{(3.45)}{0.612} + \underset{(7.99)}{0.6926}\,(MORT_{t-1} - BONDS_{t-1}) + \underset{(0.44)}{0.083}\,(MORT_{t-2} - BONDS_{t-2})$$

$R^2 = .583$ SEE = 0.698 D.W. = 2.03
SIMPL: 1972:1 - 1983:3

$$MORT_t - BONDL_t = \underset{(2.70)}{0.272} + \underset{(10.65)}{0.903}\,(MORT_{t-1} - BONDL_{t-1}) - \underset{(0.19)}{0.017}\,(MORT_{t-2} - BONDL_{t-2})$$

$R^2 = .768$ SEE = 0.230 D.W. = 2.00
SIMPL: 1960:3 - 1971:12

$$MORT_t - BONDL_t = \underset{(3.89)}{0.686} + \underset{(8.04)}{0.699}\,(MORT_{t-1} - BONDL_{t-1}) + 0.036\,(MORT_{t-2} - BONDL_{t-2})$$

$R^2 = .529$ SEE = 0.639 D.W. = 2.01
SIMPL: 1972:1 - 1983:3

MORT = 5-year conventional mortgage rate
BONDS = 3-5 year Government of Canada Rate
BONDL = 5-10 year Government of Canada Rate

Appendix C

ALTERNATIVES TO MORTGAGE RATE (OR PAYMENT) INSURANCE: CALLABLE MORTGAGE LOANS FINANCED BY CALLABLE DEBT INSTRUMENTS

The purpose of this Appendix is to explain the mechanics and to identify the nature of the underwriting risk behind alternative mechanisms for - in effect - providing mortgage insurance. In Appendix A, the simple form of the Pesando-Turnbull proposal was discussed and it was argued it was deficient because it exposed the CMHC to instrument (especially) and amortization risk.

The underlying logic of the Pesando-Turnbull proposal was that to offset the risk of mortgage insurance, it was necessary for the CMHC or financial institutions to be able to issue extendible or retractable bonds with the issuer having the option to alter the maturity of the bonds. Drawing on this insight, two alternatives are discussed. In the first alternative, the CMHC issues 10-year bonds and with the proceeds makes 10-year callable mortgage loans. It will be argued that this removes instrument risk from the CMHC, though there will be reinvestment risk arising because of the amortization of principal in the mortgage. In the second alternative, financial institutions replace the role played by CMHC.

CMHC Issues Callable Bonds and Makes Callable Mortgage Loans

CMHC issues 10-year bonds and at year 5 it has the option to call the bonds. With the proceeds from this issue, it makes 10-year callable mortgage loans.* The home owner has an option to call the mortgage after 5 years. If after 5 years mortgage rates have fallen, then it will be in the interests of the home owner to call the mortgage and to take out a new mortgage at the lower rate.

The required rate of return on the CMHC bond will reflect the value of the option to retract the maturity of the issue. The premium associated with this option can be determined by comparing the CMHC bond with a straight 5 year Government of Canada bond**. In pricing the callable (or - equivalently - insured) mortgage, the premium is added to the conventional 5-year mortgage rate. Servicing costs will also be added to the premium. For example, if the conventional 5-year mortgage rate is 14% and the amortized value of the put option is 100 basis points, then the mortgage rate on the 10-year, callable mortgage is 15%. It is assumed that the interest rate on the 10-year, retractable bond issued by CMHC is 12%. Interest payments on the CMHC bond will be paid for by the mortgage payments it receives. These mortgage payments will typically be greater than the interest payments for two reasons: the mortgage payments contain amortization of principal and mortgage rates typically contain a liquidity premium. The excess can be reinvested by CMHC.

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*It is assumed that such loans are made without any delay. The practical implications of relaxing this assumption are discussed in Chapter 6.

**A numerical example is given in Appendix A.

In 5 years time if mortgage rates have increased, the mortgage borrower should elect to keep the mortgage. The ability of the CMHC to offset this risk by electing not to retract the maturity of its bond, depends upon whether the spread between mortgage and bond rates has changed. For example, if 5-year mortgage rates are above 15%, then mortgage borrowers should elect to keep the mortgage. If 5-year bond rates are above 12%, the CMHC should elect not to retract the maturity of its bond. If 5-year bond rates are below 12%, then CMHC should retract its bond and issue a new 5-year straight bond, and reap the financial benefits*. If 5-year mortgage rates are below 15%, then the mortgage borrowers should elect not ro renew the mortgage. If 5-year bond rates are still above 12%, then it may be CMHC's advantage not to retract and to take the proceeds from the mortgage loan which has been repaid and to invest it in a 5-year bond. If 5-year bond rates are below 12%, then CMHC should retract the maturity of its bond. However, CMHC is exposed to risk: if it calls its bond at par, the par value will be greater than the final payment it receives from the home owner. This difference arises because of the amortization of the principal in the mortgage. CMHC can use the excess cash flows generated over the first 5 years of the mortgage to offset this diffrence. The ability to do this depends in part on the level of interest rates over the 5 year period. CMHC will face this reinvestment risk in year 10 if the mortgage is not called in year 5.

While this type of scheme allows CMHC to avoid the adverse consequences instrument risk, it is exposed to reinvestment risk. In theory,

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*This argument ignores transaction costs.

compensation for bearing this type of risk should be reflected in the insurance premiums. It is worthwhile to note, however, that deposit-taking institutions typically bear this risk in the normal course of their activities, since they make self-amortizing mortgage loans and issue interest-only deposits.

Private Lenders Issue Callable Deposits, Make Callable Mortgage Loans

The only difference which arises when financial institutions replace the role played by CMHC, is that the yield on the callable deposits issued by financial institutions will be greater than the yield on similar bonds if issued by CMHC, due to the possibility of default (if the deposit exceeds the insurable maximum) and since the deposits do not have the same liquidity as government bonds. Further, as noted in Chapter One, the price of the call option embedded in these deposits may be greater than its price if embedded in a primary security, at least if depositors at financial intermediaries are more risk averse than investors who participate directly in the market for primary securities.

Summary

The alternatives discussed eliminate instrument risk but not reinvestment risk. This risk arises because the CMHC or financial institutions issue non-amortizing bonds or deposits and invest in self-amortizing mortgages. The differences in the payment streams arising because of the amortization of principal in the mortgages, give rise to the reinvestment risk.

James E. Pesando
Stuart M. Turnbull
June 1983

Appendix D: MORTGAGE-BACKED SECURITIES TIED TO POOLS OF INDEXED MORTGAGES: PRELIMINARY NOTES

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1. The Demand for Indexed Mortgage Loans
2. The Supply of Indexed Mortgage Loans
3. The Design of an Indexed Mortgage
4. Mortgage-Backed Securities
5. Implementation: A Trial Issue to Establish Market Potential
6. Indexed Financing: Notes on "Outstanding Research Issues/Questions"
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Appendix D

MORTGAGE-BACKED SECURITIES TIED TO POOLS OF INDEXED MORTGAGES: PRELIMINARY NOTES

1. The Demand for Indexed Mortgage Loans

This is the key unknown in any discussion of the prospective introduction of indexed mortgage loans. Economic analysis suggests that the known real interest rate on an indexed mortgage loan may be significantly less than the expected real interest rate on an otherwise identical traditional mortgage. We do not know (1) the extent of the expected reduction in the real interest rate or (2) whether, given this reduction, the demand for indexed mortgage loans will be significant.

The 5-year conventional mortgage rate of 13% (June 15, 1983) might well correspond to an implied real rate of 7% or so, in view of the substantial inflation risk premium that is presently embedded in nominal yields. If a 10-year, callable mortgage rate were priced at 13% plus 1% or 1½%, then the implied real interest rate would approach 8%. No one, of course, can predict exactly what the equilibrium real interest rate on indexed mortgages would be at present. In its background simulations for the Lortie Commission, Pouliot, Guérard Inc. assumed a real interest rate of 4%. This would appear to be a useful first "guesstimate", to be refined (if desired) by discussions with pension fund managers and (possibly) underwriters.

Who would be interested in taking out an indexed mortgage? In theory, a commercial developer or the developer of multiunit rental housing would be attracted to the concept if the developer felt that the real stream of gross revenues generated by the project were likely to be quite stable. An individual who was similarly confident that his/her real income would be quite stable, perhaps around a rising trend, would also be a possible candidate.*

2. The Supply of Indexed Mortgage Loans

Pension funds are the natural buyers of indexed mortgage loans, perhaps in the form of mortgage-backed securities tied to pools of indexed mortgages. This is due to two facts. First, access to indexed mortgages would permit pension funds to sell indexed annuities. Secondly, pension fund earnings are tax exempt, so that the known pretax real return (if the indexed mortgage is held to maturity) translates into a known after-tax real return.

In its recent Green Paper, Better Pensions for Canadians, the Federal Government proposed that the "excess interest" principle be used to improve the inflation protection provided by private pension plans. The advantages and disadvantages of this approach are being hotly debated, with greater or lesser degrees of understanding. The crucial points are as follows. If property implemented, the "excess interest" approach must be linked to a portfolio of very short-term securities, in order to provide (relatively) stable real retirement incomes. If this is done, indexed annuities hedged by the acquisition

*For simplicity, we can assume that there is no capitalization of the inflation adjustment, so that the tilt problem is not addressed. As a result, the sole focus is on the expected reduction in the real cost of the indexed relative to a traditional mortgage loan.

of indexed mortgages will dominate the "excess interest" approach, both in terms of (1) the effective degree of inflation protection and (2) the real return provided on the protected annuity.* As this point is better understood, the attractiveness - in principle - of pension funds investing in indexed mortgages will be enhanced. Two as-yet-unresolved issues are (i) how indexed mortgages might be integrated into an "excess interest" approach and (ii) how indexed annuities hedged by indexed mortgages might complement/compete with an "excess interest" initiative.

3. The Design of an Indexed Mortgage

The crucial design feature is likely to be the extent to which the inflation adjustments are capitalized. Recent research has established (1) the relatively low correlation, over (say) six-month or annual intervals, between house price movements in local markets and the overall rate of inflation and (2) the apparent lack of enthusiasm of borrowers for "negative amortization". These results suggest that the capitalization of inflation adjustments into principal - at least for mortgages on owner-occupied residences - would presumably be small, probably not in excess of 25%.**

In view of the fact that those who took out variable rate mortgages apparently preferred some short-term fixity in nominal mortgage payments, this feature might be offered as an option with the indexed mortgage.

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*For a critical review of the "excess interest" approach as presently proposed, see J. Pesando, "The Use of 'Excess' Pension Fund Earnings to Provide Inflation Protection for Private Pensions". Ontario Economic Council, Discussion Paper Series, 1983.

**One should note, however, that pension funds might prefer 100% capitalization, since this would permit them to provide annuities which remained constant in real terms without assuming any reinvestment risk.

Nominal mortgage payments could be fixed for a set period, based on the expected rate of inflation, with appropriate adjustments to follow based on any divergence between the actual and expected inflation rates. (This is referred to in the Pouliot, Guérard Inc. study as "incidental capitalization". See page 48.)

4. Mortgage-Backed Securities

The role of CMHC as a direct provider of indexed mortgages, with the subsequent repackaging into mortgage-backed securities with the usual guarantee, parallels much of the earlier discussion. In particular, the CMHC would facilitate the introduction of a new mortgage instrument by bearing the start-up costs, and again recognizing the likelihood that this instrument would only appeal to a subset of those renewing or taking out new mortgage loans. One substantive difference lies with the insurance of the new instrument against default, which the CMHC (presumably) would need to perform explicitly. Another substantive difference would relate to the (absence of) call provisions with this instrument. Because (ex ante) real interest rates are far more stable than nominal interest rates, borrowers attracted to this instrument would probably be satisfied if the real mortgage rate were set for an initial term of (say) 5 years.

5. Implementation: A Trial Issue to Establish the Market Potential

Parallel to the discussion in Chapter 5, it would appear to be appropriate for the CMHC to undertake a trial issue to establish the potential demand by borrowers for this new mortgage instrument. The CMHC would need to establish (1) the terms (down-payment, amortization

period, capitalization of the inflation adjustment) for the indexed mortgages, (2) the insurance premium for default risk, and (3) an initial real mortgage rate of (say) 4%. The CMHC could set an initial limit of (say) $25 million of indexed mortgage loans, to be available at a real interest rate of (say) 4%. When the funds are subscribed, the CMHC would then repackage the indexed loans and sell them in the form of mortgage-backed securities to pension funds. The equilibrium real interest rate, which may be greater or less than 4%, will be the rate at which the pension funds are willing to hold the mortgage-backed securities. It will clearly be important to solicit information from pension funds in advance regarding the real rate of return that they are likely to require to hold the securities, in order to minimize the possibility of capital gains or losses when the indexed mortgages with the coupon rate of (say) 4% initially begin to trade competitively. Once this occurs, of course, the CMHC would be able to extract a signal from the marketplace as to the appropriate coupon rate on subsequent indexed mortgages loans. There is, of course, reason to expect that the equilibrium real return will vary over time, although such variations are likely to be small relative to variations in nominal mortgage rates.

As an alternative to this initiative, the CMHC might choose to introduce indexed mortgage loans in the context of one or more of its social housing programs. Here, the primary purpose would be to introduce the instrument, and then provide market participants with the opportunity to observe the operation of indexed loans in practice. After extending the indexed mortgage loans, the CMHC could again repackage them in the form of mortgage-backed securities, to be sold to pension funds.

6. Indexed Financing: Notes on "Outstanding Research Issues/Questions"

1. There would appear to be a strong case, for default insurance as well as for the mortgage-backed securities, to standardize - at least initially - the basic design of the indexed mortgages. Unfortunately, the key unknown remains the potential demand for this type of instrument by mortgage borrowers, which implies - as a corollary - that the preferred design from the borrower perspective remains unknown. There is much anecdotal evidence that borrowers do not like negative amortization (there is nothing in FNMA's survey of the GEM which disputes this view), and earlier work commissioned for the CMHC (and confirmed by Pouliot, Guerard Inc. for the Lortie Commission) suggests that capitalization in excess of 25%-50% would lead to an unacceptable increase in default risk.

2. A formal survey of potential borrowers is probably an unnecessary step to determine the potential demand (and preferred design). If a series of informal discussions with builders regarding the possible use of this instrument, either for themselves or as a way of increasing the attractiveness to purchasers of the housing they build, fails to generate any interest, then the unsubsidized indexed mortgage is probably a non-starter. The remaining question would then be whether the theoretical/potential attributes of the indexed mortgage merited (say) a specific initiative designed to familiarize the market with the instrument. Is it possible

to link the initial introduction of indexed mortgages to direct CMHC lending for social housing?

3. The potential advantages of the indexed mortgage have been reviewed in the content of the Lortie Commission. The following are quick answers to the specific questions being raised.

3.1 Given the Canadian experience with VRM's, and the results of the GMMA survey, it would appear that borrowers would prefer some smoothness (fixity?) in their nominal payments. This could be accomplished by setting nominal payments for a period of (say) 3 years on the basis of the average rate of inflation expected over the next 3 years, as deduced from nominal interest rates or private forecasters. Adjustments to correct for the difference between the actual and expected inflation rate could be built into the revised nominal payments, to be set at the end of year 3.

3.2 There appears to be no reason to dispute the finding of the background study for the Lortie Commission, which suggests that more than 50% capitalization for individual owner-occupied properties is likely to lead to an unacceptable rise in default risk. For commercial or mixed residential/commercial properties, where real gross rents may prove to be relatively stable, 50% capitalization (or more) might prove to be satisfactory.

To the best of our knowledge, this latter issue has not been carefully examined, in either Canada or the U.S. Yet it is perhaps a logical location for this innovation, given (for example) that commercial rents are often tied to what may be a surrogate for the consumer price index, such as gross sales.

3.3 We can only make an "educated guess" as to the effective reduction in borrowing costs. We know neither (1) the expected inflation rate built into nominal interest rates nor (2) the real return (which is likely to vary over time) required by lenders on a portfolio of (say) 5-year, insured indexed mortgages. It would undoubtedly be useful to solicit input from pension fund managers as to the real return that they might require on 5-year, insured indexed mortgages at this point in time.

3.4 Received economic analysis suggests that the real interest rate on indexed instruments are likely to vary over time, and that there is no reason to believe that there will be a predictable relationship between the real interest rate on indexed instruments and the rate of inflation, whether anticipated or not. (There is a theoretical reason why an increase in the rate of inflation may be associated with a decline in the real interest rate, although this effect is likely to

be of minor quantitative importance.) It should be possible to bring evidence to bear on this issue by monitoring the price behavior of the variety of indexed bonds (liabilities of the U.K. Government) that trade in the U.K. capital market.

3.5 Because all of (1) the expected inflation rate, (2) the inflation risk premium and (3) any taxation premium are unobservable, it is not possible to speak confidently of their relative empirical importance. Two points merit note. First, it is unlikely (in our view) that a taxation premium is an important contributor to the high level of implicit real interest rates that we observe today, given that the inflation rate is far beneath its previous levels. Secondly, to the extent that indexed mortgages are targeted to tax-exempt pension funds, the tax premium and the inflation risk premium cease to be relevant. (They remain relevant indirectly since pension funds, of course, retain the opportunity to invest in traditional debt instruments.)

3.6 If the indexed mortgage were (say) a 5-year mortgage, the borrower would know in advance the real cost of his loan for the 5-year period. Such would not be the case with a VRM. Further, inspection of the data on (say) the prime rate less the actual inflation rate

would highlight the volatility of the ex post real interest rate on the VRM. Again, the big unknown is the extent to which some borrowers would value the fact that this real interest cost would be known in advance.

3.7 The term for which the real interest rate is fixed would be a design issue, perhaps influenced by the Interest Act. In view of the fact that the real interest rate on an indexed mortgage will be far more stable than the nominal interest rate on a traditional mortgage, this issue is probably somewhat less important here. Offhand, it would appear that the 5-year term might be preferred, thus preempting the need to work through the prepayment privileges to be accorded a longer-term index mortgage. The latter would become important once a market for index mortgages develops, since borrowers would be able to observe - and perhaps wish to act upon - movements in real interest rates.

3.8 Again, this is a design issue which is linked ultimately to the (unknown) nature of the demand for indexed mortgages. Three points merit note:

(1) Although inflation has now fallen to 6.5%, there is no reason to presume that it will not rise again. In short, one does not want to place

undue emphasis on the current rate of inflation in pursuing this design issue.

(2) In general, the elimination of the inflation risk premium is in and of itself sufficient to warrant a closer look at the indexed mortgage.

(3) To the extent that life companies or pension funds wish to use indexed mortgages to hedge indexed annuities which are constant in real terms, they might prefer more capitalization of the inflation adjustment to less.

4. The market acceptance of mortgage-backed securities based on pools of indexed mortgages.

4.1 See Section 2 of Appendix D. Although an informal survey of the opinion of pension fund managers should be sufficient to establish their interest, the role of this initiative in the context the "excess interest" proposal in the Federal Government's Green Paper on pension reform may merit clarification.

4.2 At least initially, it is likely that pension funds would be the major/exclusive investors in indexed mortgages. In view of the possibility that this instrument will appeal to a fairly small subset of borrowers, it is quite possible that the introduction of indexed mortgages may not extend beyond this "natural clientele".

4.3 See Section 4 of Appendix D. Details on the indexed bonds that trade in the U.K. capital market may also be of interest on this account.

4.4 Because the demand by borrowers for indexed mortgage loans is unknown, and for reasons parallel to those advanced in the text, it seems more reasonable for the CMHC first to issue the indexed mortgages, and then - perhaps depending upon the response - to finance them by mortgage-backed securities (if successful) or indexed bonds (if less successful).

4.5 We see no reason why this would not be the case. Again, an informal survey of opinion should answer this question quite quickly.

5. We are not sure what the tax consequences for life insurance companies would be. The discussion in the Lortie Report (page 87) suggests that inflation adjustments as well as real interest payments would be tax deductible to rental investors. It is not clear (to us) if a decision to capitalize a part of the inflation component would alter the timing of the tax deductible expense. In general, we think it would be useful if the CMHC contacted those who worked on or are familiar with the legal issues raised in the discussions of the Lortie Commission.

6. A review of certain of the legal issues is contained in the Lortie Report, pages 59-67. Again, this is an area for legal, not economic, expertise.

7. Brief Comments on FNMA Survey of Households Regarding Preferred Mortgage Design

The major points that appear to be relevant (or not relevant!) for the discussion of indexed mortgages in Canada are as follows.

1. A greater variety of instruments, presumably including instruments such as the indexed mortgage, is preferred to less. Even if only (say) 5% of borrowers were initially interested in an indexed mortgage, this might well be sufficient to justify the initiative.

2. For the GEM, the change in the annual payment (e.g. if linked to the consumer price index) is applied solely to the principal of the mortgage. The potential appeal of the GEM thus does not convey information regarding the appeal of an indexed mortgage, where such changes would pertain to the equivalent of interest.

3. Because of the differential tax incentives in the United States, the favourable response to the GPM conveys less information regarding its appeal to Canadian borrowers (Note, by contrast, that an unfavourable response to the GPM in the United States would suggest an unfavourable response in Canada.)

4. The discussion of the ARM strongly suggests that some smoothing of nominal payments is likely to be required if the indexed mortgage is to be made attractive to borrowers.

5. This survey was conducted in March/April 1982, before the dramatic drop in the U.S. inflation rate was established. The fact that nominal mortgage rates have fallen less rapidly than inflation invites the question of whether, if the survey were conducted today, the indexed mortgage might have been included as an option.

6. One can speculate that, perhaps, the potential complexity of the concept of an indexed mortgage precluded its inclusion. (Alternatively, the fact that nominal mortgage interest payments are tax deductible might have worked against its inclusion, lest it become the 'foot in the door' through which tax reform is initiated.)

7. The favourable response to the EPM, although perhaps surprising to economists, does offer indirect evidence that some Canadian borrowers may be attracted to 10-year, callable mortgages.

8. The fact that 47% of those surveyed favoured a VRM initially at 14% over a fixed rate mortgage of 17% (while 39% favoured the latter) does suggest that the potential interest rate saving with the indexed mortgage may be sufficiently important to attract borrowers to the indexed instrument. Further results (Table 42, page 46) suggest that a risk-return tradeoff does exist for many potential mortgage borrowers.

9. Most respondents, particularly non-owners, were not familiar with alternative mortgage rate instruments. This fact places the unknown demand by borrower for indexed mortgages in a useful perspective.

June 1983

A REVIEW OF MORTGAGE RATE INSURANCE

A Report Prepared for
Canada Mortgage and Housing Corporation

by

James E. Pesando and Stuart M. Turnbull

I. Introduction

Over the last decade the level and variability of nominal interest rates has increased in North America. In response to these changes, innovations in the design of mortgage instruments has been undertaken as a means of facilitating different degrees of risk sharing. For mortgage lenders the increase in the variability of interest rates has increased the risk of issuing equal payment mortgages (EPM's). To reduce this risk, lenders have responded by reducing the maturity of EPM's and by issuing such instruments as the variable rate mortgage. For mortgage borrowers, an increase in the fully anticipated rate of inflation changes the time profile of real mortgage payments, giving rise to what is known as the "tilting problem". Mortgages, such as the graduated payment mortgage, have been introduced in an attempt to alleviate the tilting problem.

An unanticipated increase in nominal interest rates can have serious financial implications for financial institutions that borrow short and lend long. For mortgage lenders this can be a serious problem and it can adversely affect the supply of mortgage funds. Edelstein and Guttentag* explore the idea of the U.S. Government providing mortgage rate insurance to financial institutions. Perhaps because of severe implementation problems and the uncertainty surrounding the possible magnitude of the liability, such an idea seems never to have been

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* R. Edelstein and J. Guttentag, "Interest Rate Change Insurance and Related Proposals to Meet the Needs of Home Buyers and Home Mortgage Lenders in an Inflationary Environment". Capital Markets and the Housing Sector: Perspectives on Financial Reform, edited by R.M. Buckley, J.A. Tuccillo, and K.E. Villani, Cambridge, Massachusetts: Ballinger Publishing Company (1977).

implemented. Kaufman* has suggested that the Government (U.S.) provide mortgage rate insurance by allowing financial institutions to issue variable rate mortgages. Mortgage borrowers would receive insurance payments if the variable rates charged over the life of the mortgage averaged more than the rate on a comparable fixed rate mortgage that could have been taken out at the same time. The key issue of determining a fair market price for the insurance and the implications if a subsidized price is used, are given scant attention.

In Canada mortgage rates have gone from around 11% at the start of 1979 to a high of approximately 22% in 1981. Such a change in mortgage rates has had a dramatic effect on the ability of mortgage borrowers to carry mortgages. In response to this change in mortgage rates and the uncertainty about future rates, financial institutions responded by shortening the term of EPM's and by introducing the variable rate mortgage. For new mortgages this reduces the risk to financial institutions by shifting the risk to the mortgage borrower.

It is against this background that the CMHC started to explore possible initiatives to assist mortgage borrowers. The risk facing the mortgage borrower is that at the time of renewal, mortgage rates may have increased to an unacceptable level. For the person thinking about taking out a new mortgage, the uncertainty of future mortgage rates and hence the level of future mortgage payments may act as a deterrent to undertaking the planned purchase. The idea of mortgage rate insurance (MRI) was introduced as a means for mortgage borrowers to shift the risk of adverse changes in the mortgage rate to a third party. For a price

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* G.G. Kaufman, "TheCase for Mortgage Rate Insurance", Journal of Money, Credit and Banking, Vol. 7 (November 1975), 515-519.

mortgage borrowers would be able to purchase insurance from a third party. If mortgage rates had increased at the time of renewal, the insured mortgage borrower would be able to renew the mortgage at some predetermined level. The insurer would pay the difference.* If mortgage rates had decreased or remained unchanged at the time of renewal, the insurance would not be used.

If such a scheme is to be undertaken, two interdependent questions must be asked: what is a fair market price for such insurance? and is it possible for the insurer to offset such risk?

To offer insurance against an increase in mortgage rates differs from ordinary forms of insurance, such as life insurance, in an important way. Ordinary forms of insurance cover events which are usually independent. However, an adverse increase in mortgage rates could precipitate a large number of claims. Hence MPI cannot be priced in the same way as is life insurance.

At the time to renew a mortgage, if mortgage rates have increased, so that values of existing mortgages have fallen, then the insurance will be utilized. If mortgage rates have fallen or remain unchanged, then the insurance will not be utilized and is worthless. To offer MPI is equivalent to selling a put option.** This is an important insight. It implies that to price MPI, the option of being able to renew a mortgage must be embedded in some form of financial instrument, so that the market determines a fair market price for the insurance, or

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*In MRI the difference in interest payments would be paid. A more general form of insurance is mortgage payment insurance (MPI), where the difference in mortgage payments (interest plus the amortization of principal) would be paid. Throughout the rest of this Report, the term MPI is used unless it is necessary to distinguish between the two forms of insurance.

**An American put option is a contract giving the owner the right to sell the underlying asset at a stated price on or before a stated date. A European option is one that can only be exercised at maturity.

option theory must be used to explicitly price the put option.

To offer MPI at a price which differs from its fair market value implies the existence of an implicit or explicit subsidy. The existence of such a subsidy could cause possible distortions in real estate markets. For CMHC to offer MPI at subsidized rates would preclude other financial institutions from offering such a service.

The ability of the CMHC to be able to completely offset the risk inherent in offering such insurance depends on the form in which such insurance is offered. If the option is embedded in some form of financial instrument, then by offering an instrument with similar characteristics, it can completely offset the risk. Alternatively, if it sells MPI directly as a separate package, then to offset the risk it is necessary to purchase a put option. Unfortunately, there is no market for such an option. Consequently, to offset such risk it is necessary to construct a portfolio to replicate such an option.

The first study commissioned by the CMHC was the Wyatt Report.* Though MPI is equivalent to a put option and thus modern option theory can be used to price MPI, this study uses the traditional discounted cash flow technique. A brief description of the study is given in Section II. One of the difficulties of using the discounted cash flow technique is that it is necessary to explicitly estimate expected cash flows and risk adjusted discount rates. Modern option theory avoids these difficulties. The second study commissioned by the CMHC was the

*"Insurance Protection Against High Payment Increase on Mortgage Renewal: Further Research Work", by the Wyatt Company, September 1981.

Gau and Capozza study*, which introduced a simple options model to explicitly price MPI. Using this report, CMHC commissioned a third study to examine the feasibility of CMHC being able to offset the risk associated with MPI. The results of this study are contained in the Arthur Andersen report.** The Gau and Capozza study is described in Section III and the Arthur Andersen report in Section IV.

Instead of offering MPI as a separate package, it is possible to embed the option for a mortgage borrower to renew a mortgage in the form of a financial instrument, such as a callable mortgage. This simple insight was first advanced by Pesando and Turnbull.*** In a follow-up study commissioned by the CMHC to identify implication problems, Pesando and Turnbull**** argued that for CMHC to be able to offset the risk it should issue mortgage-backed securities. These studies are described in Section V. Conclusions are presented in Section VI.

II. The Wyatt Report

The need for MPI arises because of the uncertainty of future mortgage rates. The value of MPI will depend on the nature of the stochastic process that describes future mortgage rates. Given that MPI is equivalent to a put option, modern option theory, which explicitly

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* G.W. Gau and D.R. Capozza, "Mortgage Rate Insurance: Overview, Risk Management, and Pricing", June 1982.

** "Mortgage Rate Insurance", Arthur Andersen & Co., February 1983.

*** James E. Pesando and Stuart M. Turnbull, "The Pricing and Reception of Bonds Extendible at the Option of the Government of Canada", May 13, 1983.

**** James E. Pesando and Stuart M. Turnbull, "Retractable Debt Instruments and the Provision of Mortgage Rate Insurance and/or the Introduction of 10-year Mortgages Callable After 5 Years", June 13, 1983.

considers the stochastic process describing changes over time in the value of the underlying asset, can be used to price MPI and hence immediately determine the insurance premiums.

The approach used in the Wyatt report does not draw on modern option theory to price the insurance. Instead it adopts a traditional discounted cash flow technique and consequently it must determine the expected cash flows and the appropriate discount rates. This is accomplished by making a series of ad hoc assumptions. Some form of arbitrary projection (this is not adequately described in the report) is used to estimate expected mortgage rates. From the brief description in the report it is difficult to follow how estimates of the insurance premiums are derived. There is no discussion of how uncertainty affects the estimate of the discount rates over time.

As any form of model is usually based on a number of simplifying assumptions, it is perhaps best to judge a model on the accuracy of its predictions. Unfortunately, no attempt was made to test the robustness of the model. Though presented with a very simple form of model, the reader has no way of judging the accuracy of the model. However, given the ad hoc and simplified form of the model, especially the neglect of how changes in the degree of uncertainty affect the value of the put option, it is unlikely that the model would provide accurate and robust estimates of the insurance premium.

III. The Gau and Capozza Report

Given that MPI is equivalent to a put option, Gau and Capozza (GC) use a simple option pricing model to estimate the value of MPI and

the hedge ratio.* They also use the model to discuss possible ways of offsetting the risk. The model used by GC is a modified form of the original Black-Scholes option pricing model. It is assumed that the stochastic process describing the market value of a mortgage is log-normal, and that the instantaneous expected rate of return and the instantaneous variance of return are constant over time. To incorporate mortgage payments, it is assumed that mortgage payments are proportional to the market value of the mortgage; that is, if the market value of the mortgage increases (decreases) then the mortgage payment increases (decreases) by a proportional amount. It is also assumed that the short-term rate of interest is constant over the life of the put option. Given these assumptions, it is possible to obtain a simple expression giving the estimated value of the put option. The only unknown parameters that must be estimated are the instantaneous variance of return for the mortgage and the proportionality coefficient relating mortgage payments to the mortgage value.

Though the solution developed by GC is innovative, the model is based on a number of counterfactual assumptions. It is assumed that the short term rate of interest is constant over the life of the option, though the market value of the mortgage is subject to random fluctuations. The assumption that the short-term rate of interest is constant over a period spanning possibly many years** is difficult to justify. For most, if not all, mortgages, mortgage payments are <u>not</u> proportional to the market value of the mortgage. It is assumed that the stochastic process

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*The hedge ratio provides the insurer with important information about how to offset the risk of writing such insurance.

**Presumably MPI insurance would be offered for extended periods of time, such as one to five years.

describing the market value of the mortgage is stationary. While such an assumption may be appropriate for stocks, it cannot be the case for an instrument with finite maturity.*

The simple model used by GC, though based on a series of unrealistic assumptions, may be adequate if its predicted values are "reasonably close" to observed market values. Unfortunately, no evidence is presented which examines the accuracy of the model. While direct testing is not possible, as mortgage options do not yet exist, the model could be tested on bond options.

The failure to test the robustness of the model implies that if MPI is to be offered by CMHC on the basis of premiums estimated by the model then there is an implicit premium, which may preclude private lending institutions from offering MPI.

If mortgage rates rise, then the CMHC would face the possibility of having to make insurance payments. This risk could be partially offset if the CMHC shorted bond futures contracts; if interest rates increased, bond prices would fall and a profit would be made on the short futures position. However, this position is not riskless; if interest rates decrease, bond prices rise and a loss is made on the futures position. There is no offsetting gain on the MPI. The second part of the GC study examines the possibility of using futures markets to offset the risk associated with MPI. While a few examples were presented to illustrate the argument, a detailed analysis was not attempted. To provide a detailed analysis, CMHC commissioned the Arthur Andersen study.

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*Detailed reviews of the GC study are given in Stuart M. Turnbull, "Comments on Chapter III", February 1983, and Phelim P. Boyle, "Analysis of Two reports on Mortgage Rate Insurance", May 1983. Both reports were commissioned by CMHC.

IV. The Arthur Andersen Report

To offer MPI at a rate which does not involve any form of subsidy requires that the insurer be fully compensated for the risk. As MPI is equivalent to a put option, then an insurer can completely offset the risk by purchasing a put option, assuming that a market for such options exists. If a market for such options does not exist, then it may be possible to construct a portfolio that replicates the put option; that is, the value of the portfolio is equal to the value of the put option at all points in time. If a portfolio fails to replicate the payoff of the put option, then it is said to contain residual risk. In the pricing of insurance policies, it is necessary for the insurer to identify the risks associated with underwriting such insurance. If the insurer is able to construct a replicating portfolio that has no residual risk, then the insurance policies should be priced as put options. If the replicating portfolio has residual risk, then this should be taken into account in pricing the insurance policies. In this case the value of the put option provides a lower bound in the pricing of the insurance.

MPI is equivalent to a European put option.* It is contemplated that MPI will be offered for periods up to five years. Currently traded bond options are written on Government bonds. These options are American options with maturities up to nine months. As the pricing characteristics of Government bonds differ from mortgage debt instruments, it is not readily possible to use existing option markets to offset the risk associated with underwriting MPI. However, CMHC may be able to

*A European put option can only be exercised at maturity.

offset this risk by constructing a portfolio that replicates the European put option.

From modern option theory it is known that to replicate a put option written on a debt instrument, it is necessary to be able to short the debt instrument and with full use of the proceeds to invest in the riskless asset. The number of debt instruments per put option to short is given by the hedge ratio. As the price of the debt instrument changes and the maturity of the option decreases, it is necessary to readjust the portfolio. But the requirements of shorting the debt instrument, full use of proceeds, and continuous revision of the portfolio are, in general, impossible to implement. The first two difficulties can be overcome by using futures contracts. However, the number of futures contracts to short is no longer given by the hedge ratio.* There is no escaping the consequences of the third difficulty. Discrete time adjustment of the replicating portfolio implies the portfolio contains residual risk. This implies that the insurer cannot offset the risk of underwriting MPI and this will affect the pricing of such insurance.

In the Arthur Andersen (AA) study, it is argued, following Lau and Capozza, that because Canadian futures markets are too small, it is necessary to use futures markets in the United States. This implies shorting futures contracts on some debt instrument, such as Ginnie Maes, and hedging the foreign exchange risk. The use of futures contracts written on a different underlying asset raises two additional problems. Ideally one would want to pick an instrument such that changes in the

*This is demonstrated in Stuart M. Turnbull, "Offsetting the Risk of Mortgage Rate Insurance", March 1983. This study was commissioned by the CMHC.

value of the instrument are perfectly correlated with changes in Canadian mortgage rates. Failure to pick an instrument that is not perfectly correlated implies that the insurer is exposed to residual risk. There is no a priori reason why changes in mortgage rates in Canada should be perfectly correlated with changes in mortgage or bond rates in the U.S. In order to form the replicating portfolio, it is necessary to determine the number of futures contracts to short. As already mentioned, the hedge ratio is inappropriate for futures contracts. The AA solution to this problem is to adopt an ad hoc hedge ratio based on a series of regression equations.

The central question is whether it is possible to construct a portfolio that would replicate a put option. The results from the AA study show that they were unable to do this. If the portfolio was able to replicate the put option then the ratio of the reserve (the value of the portfolio) to the claim (the value of the put option) should equal unity. In a table* showing the average reserve/claim ratio for different MPI packages, in all cases this ratio was not equal to unity. The failure to replicate the put option has important implications for an insurer. It implies that an insurer would not have been able to offset the risk arising from underwriting MPI and hence this should be reflected in the pricing of such insurance.**

A major criticism that has been leveled against the use of futures markets in the U.S. is that it is quite possible for historical relationships to change, which could result in catastrophic losses to CMHC.

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*See Table IV-4 in AA.

**Detailed reviews of the AA report are given in Phelim P. Boyle, "Analysis of Two Reports on Mortgage Rate Insurance", May 1983 and Stuart M. Turnbull, "Offsetting the Risk of Mortgage Rate Insurance", March 1983.

For example, mortgage rates in Canada could rise, bond rates in the U.S. fall and the Canadian dollar appreciates against the U.S. dollar. This is no way for the CMHC to protect itself from this type of contingency if it uses U.S. futures markets.* It has been argued that this type of risk would probably prevent private lending financial institutions from offering MPI.**

V. The Pesando-Turnbull Proposal

Pesando-Turnbull (PT) proposed a means for the CMHC to offset the risk in underwriting MPI. It was proposed that the CMHC issue bonds which are extendible at the CMHC's option and uses the proceeds, together with the insurance premiums, to purchase otherwise identical bonds without the extendible option. In providing MPI, the CMHC effectively sells a put option. By using these extendible bonds and purchasing non-extendible bonds, the CMHC buys an identical put option. Hence, the CMHC bears no underwriting risk.*** The insurance premium, per dollar of the insured mortgage principal, is equal to the spread between the interest rate on the extendible bond and the interest rate on the non-extendible bond, if the bonds are at par.

The insurance premium is market determined. There is no need for the CMHC to estimate the insurance premium based on an options pricing model. (The put option must, of course, be priced. The pricing is done by the capital market.) There is no need to calculate a time

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* This type of catastrophic event is noted in "Comments on the Mortgage Rate Insurance Proposal", Burns Fry Limited, March 1983.

** Pl, "Comments on the Mortgage Rate Insurance Proposal", Burns Fry Limited, March 1983.

*** This is true provided there is no instrument or amortization risk. This is discussed in detail in Section VI.

dependent hedge ratio and to continuously adjust some form of replicating portfolio. There is no need for transactions in U.S. futures markets or for transactions to avoid foreign exchange risk. The only innovation lies in the introduction of bonds which are extendible at the option of the borrower, not the lender.

The first question to be addressed is what is the cost of providing MPI? PT* attempted to answer this question using two different approaches. The first approach was to analyze the manner in which the market had priced existing extendible and retractable bonds, in which the option to extend or retract was held by the bond holder, relative to straight bonds. If options are priced symmetrically, so that the price is independent of whether the option is held by the issuer or bond holder, this approach should provide direct evidence on the excess yield required on the proposed extendible relative to a straight bond. The second approach was to survey the opinions of major underwriters on how the proposed bonds would be priced by the market.

In the first approach, using Government of Canada bonds, PT were able to price the put option for different periods and constructed a 'rule of thumb' for pricing such an option. Using this rule, they suggested that the premium for the put option, as of May 1, 1983, was about 105 basis points. From the second approach, the consensus view of underwriters was that the premium, as of May 1, 1983, was in the range of 75-100 basis points.

The second question to be addressed is whether it is possible to implement such a proposal.** In its original form, the PT proposal would have

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*James E. Pesando and Stuart M. Turnbull", The Pricing and Reception of Bonds Extendible at the Option of the Government of Canada", May 13, 1983.

**James E. Pesando and Stuart M. Turnbull, "Retractable Debt Instruments and the Provision of Mortgage Rate Insurance and/or the Introduction of 10-year Mortgage Callable After 5 Years", June 13, 1983.

exposed the CMHC to instrument and amortization risk. To offset the underwriting risk of MPI, it had been suggested that CMHC issue an extendible bond. However, mortgage rates and bond interest rates are not perfectly correlated, giving rise to instrument risk. Furthermore, the different payment characteristics of mortgages and bonds affect the relative price dynamics, giving rise to what is termed amortization risk.

The key insight to be drawn from the initial PT study is that MPI is functionally equivalent to providing the mortgage borrower with a callable mortgage. When the mortgage needs to be renewed, if mortgage rates have increased, then the mortgage borrower can renew the mortgage at some preassigned rate. If mortgage rates have decreased, then the mortgage borrower can call the mortgage and negotiate a totally new mortgage. To be able to completely offset the risk of underwriting callable mortgages, then it is necessary for the underwriter to issue a similar type of instrument. Mortgage-backed, pass-through securities (MBS's) would be one such instrument.

PT recommend the introduction of callable mortgages and MBS's. The callable mortgage would provide mortgage borrowers with the option to renew their mortgages at the original or some other preassigned rate and thus it is functionally equivalent to MPI. The full market price of the call option would, through competitive market forces, be embodied in the interest rate on the callable mortgages. No such result holds for any of the MPI proposals previously discussed. As there is no form of implicit subsidy, private lending institutions could offer such mortgages.

The introduction of MBS's would achieve two purposes. Firstly, it would allow mortgage lenders to offset the risk, if desired, in purchasing callable mortgages. Secondly, it would be the first step in establishing an active, liquid secondary market in mortgages. The development of such a market in MBS's would be a potential benefit to all financial institutions, as it introduces a new form of financial instrument, as well as providing mortgage lenders with a ready means to adjust their mortgage portfolios.

The idea of introducing MBS's has also been advocated by Merrill Lynch, Royal Securities Ltd. (MLRS)*, who argue that a liquid secondary market in MBS's would enhance the flow of funds into the real estate sector of the economy. If MBS's were to be introduced into Canada it would be necessary for the CMHC to provide, at a price, a guarantee of timely payment.**

VI. Conclusions

In the presence of uncertainty regarding the future path of nominal interest rates, MPI facilitates a reduction in the risk borne by mortgage borrowers. MPI is unlike ordinary forms of insurance, such as life insurance, as insured events are not independent; an increase in mortgage rates could precipitate a large number of claims. This raises two questions: how to price the premiums for MPI? and how to offset the risk in underwriting MPI? Over the last two years, CMHC has commissioned four major studies which, in different ways, have attempted to answer these questions.

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*"Mortgage-Backed Securities", Merrill Lynch, Royal Securities, March 1983.

**In the U.S., the GNMA provides a guarantee of timely payment for Ginnie Maes.

A common limitation of the Wyatt, and the Gau and Capozza studies is that no attempt has been made to test the accuracy and robustness of these models. To price the premiums associated with MPI on the basis of these models would imply the existence of an implicit subsidy. The Wyatt study is limited because of its simple ad hoc nature. The Gau and Capozza study uses a simple form of option pricing model to estimate the insurance premium. If such a model proves to be inappropriate, more sophisticated forms of option pricing models could be used. However, the criticism that the premiums derived from such models involve an implicit subsidy would still be pertinent.

The Wyatt study offers little practical advice on how the CMHC could offset the underwriting risk associated with MPI. Following a suggestion in the Gau and Capozza study, the Arthur Andersen study attempted to use U.S. futures markets to offset the risk. Their results indicated that it was not possible to completely offset such risk. Apart from the criticisms of the study that have already been noted, such an approach is flawed. To construct a replicating portfolio requires the estimation of various parameters. Historical data are used to estimate these parameters, given an implicit assumption of stationarity. But such an assumption is unlikely to hold. There are going to be occasions when, because of unanticipated events, the portfolio does not replicate the put option resulting in possibly very large losses or gains.* It has been argued that if this is the only way to offset the underwriting risk, it is unlikely that private lending institutions would be prepared to offer MPI.**

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* This point is made in a paper by Michael J. Brennan, "Mortgage Rate Insurance: Playing Craps with the Yanks", University of British Columbia (April 1983).

** Burns Fry Limited, "Comments on the Mortgage Rate Insurance Proposal", March 1983.

Pesando and Turnbull argue that to offer callable mortgages is functionally equivalent to MPI. The market determines the insurance premium, so that there is no form of implicit subsidy. There is no need to use foreign capital markets. Mortgage lenders can offset the risk, if desired, by issuing mortgage-backed, pass-through securities (MBS's). While such instruments would be new to Canada, they have been traded in the United States for over a decade. Under the guidance of the GNMA, there is now an active liquid secondary market in MBS's, which has lead to the development of a derivative futures market. The development of a liquid secondary market in Canada will be a potential benefit to all financial institutions, as it introduces a new form of financial instrument, as well as providing mortgage lenders with a ready means to adjust their mortgage portfolios.

In a broader context, two additional areas of concern associated with mortgage finance have been identified:* high real interest rates, and the tilting of real payment streams under equal payments mortgages. The tilting problem has long been recognized and much work has been done on ways to ameliorate such a problem. With regards to the problems associated with high real interest rates, it has been suggested that index mortgages would provide a solution.** While such mortgages may be advantageous for certain groups of mortgage borrowers, there are groups for which this is not the case. An implicit assumption behind the use of index mortgages is that house prices and wages keep up with

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*CMHC commissioned two studies to examine general problems associated with mortgage financing: Michael A. Goldberg, "Issues in Housing Finance in Canada: Past Achievements, Present Reality, Future Prospects", April 1983 and James E. Pesando, "An Assessment of the Problems of Mortgage Finance in the 1980's and Potential C.M.H.C. Policy Initiatives/Research Directions", April 1983.

**"Intervention and Efficiency", Economic Council of Canada, 1982.

inflation. While this may be true in the long run, there is no reason why it is necessarily true in the short run. House prices do not necessarily keep up with inflation in the short run,* and if wages are controlled, as is currently the case in the public sector in many provinces, then index mortgages may not be the best form of mortgage for certain groups of mortgage borrowers. While index mortgages may be well suited for certain mortgage borrowers, they are not a panacea.

*See James E. Pesando and Stuart M. Turnbull, "The Default Risk of Alternative Mortgage Instruments: A Simulation Study", University of Toronto (January, 1983). The fact that house prices may not keep up with inflation, at least in the short run, affects the security of the mortgage lender. Consequently, it affects the ability of the borrower to refinance a mortgage.

POOR

QUALITY

ORIGINAL